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Natural history of New York
"Division VI. – Paleontology,
Vol. 5, pt. 1, v. II.

(Geological Survey of the State of New York.)

PALÆONTOLOGY:

VOL. V. PART I.

LAMELLIBRANCHIATA

II.

TEXT AND PLATES.

CONTAINING DESCRIPTIONS AND FIGURES

OF THE

DIMYARIA

OF THE

UPPER HELDERBERG, HAMILTON, PORTAGE AND CHEMUNG GROUPS.

BY JAMES HALL,
STATE GEOLOGIST.

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ALBANY, N. Y.:
CHARLES VAN BENTHUYSEN & SONS.
1885.

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STATE OF NEW YORK,
ALBANY, *November*, 1885.

Published under the supervision of the Trustees of the State Museum of Natural History, pursuant to chapter 355 of the Laws of 1883.

DEDICATION.

To His Excellency

DAVID B. HILL,

Governor of the State of New York:

From the commencement of the publication of the Natural History of New York, the successive volumes have been dedicated to the Governor of the State. In accordance with this custom I have the honor to present to your Excellency a new volume of the work, being the second one published under the provisions of an act of the Legislature of 1883, being a continuation of the work on the PALÆONTOLOGY OF THE STATE OF NEW YORK.

This volume, together with one published last year, is devoted to the descriptions and illustrations of the fossil bivalve shells known as Lamellibranchiata, and completes the work upon that class of organisms. The two volumes embrace the descriptions of all the fossils of this class at present known to occur in the higher geological formations of the State, viz.: The Upper Helderberg, Hamilton, Portage and Chemung groups, with a small number from the Waverly group, which has its chief extension beyond the limits of New York. The material has been chiefly collected in the field, or acquired from collections previously made during a period of more than forty years. The number described in the entire work, from the formations above indicated, amount to about 500 species which are arranged under 65 genera, and are illustrated upon ninety-six lithographed plates, of which fifty-one are included in the present volume. The number and variety of forms is believed to be greater than are yet known from the geological formations of the same age in any other part of

the world, and the illustrations will compare favorably with any similar work elsewhere published.

Hoping that this volume may commend itself to your Excellency and prove acceptable to the students of science, and not unworthy of a place in the series of works comprising the NATURAL HISTORY OF THE STATE OF NEW YORK,

I have the honor to be,

With great respect,

Your obedient servant,

JAMES HALL,

State Geologist.

ALBANY, *November*, 1885.

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ERRATA.

Page lix, tenth line from bottom, for PETERINEA read PTERINEA.
Page 388, line 1, for EDMONDIA OBLIQUA, n. sp., read EDMONDIA TUMIDULA, n. sp.
Page 407, line 2, for SPATHELLA TYPICA, read SPATHELLA TYPICA, n. sp.
Page 429, line 3, for PARARCA PRÆCEDENS, read PARARCA PRÆCEDENS, n. sp.
Explanation of plate li, figs. 28–31, for DYSTACTELLA TELLINIFORMIS, read CLINOPISTHA TELLINIFORMIS.
Explanation of plate li, figs. 32, 33, for DYSTACTELLA SUBNASUTA, read CLINOPISTHA SUBNASUTA.
Explanation of plate lxiii, fig. 21, for PALÆOMYA OBLONGA, read PROTOMYA OBLONGA.
Explanation of plate lxiv, figs. 15, 16, 23, for EDMONDIA OBLIQUA, read EDMONDIA TUMIDULA.
Explanation of plate lxx, figs. 18–20, for PRÆCARDIUM VENUSTUM, read PRÆCARDIUM VETUSTUM.
Explanation of plate lxxiv, for figs. 21, 22, read figs. 20, 21.
Explanation of plate xcv, figs. 5–8, for EDMONDIA OBLIQUA, read EDMONDIA TUMIDULA.
Explanation of plate xcv, fig. 31, for DYSTACTELLA SUBNASUTA, read CLINOPISTHA SUBNASUTA.

The family names on plates xl, li, lii, lxii, lxiii, lxiv, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi, lxxiii, lxxiv, lxxv, were given without sufficient knowledge of the relations of the species and should be cancelled by the student.

PREFACE.

This volume includes the letter press and plates containing the descriptions and illustrations of the Lamellibranchiata, II, and constitutes a part of Volume V, part I, of the PALÆONTOLOGY OF NEW YORK.

I have already stated, in the preface to the preceding volume, that the original intention was to publish the work as a volume of text and a volume of plates; but the exigencies of publication made it necessary to issue the work in two parts. The inconvenience attending this plan has arisen from the necessity of adding other plates to the first part, in the Monomyaria, following plate lxxx; the plates from i to lxxx having previously been lithographed. In the present volume, the few plates added to the Dimyaria have been numbered xciii to xcvi, following the last number in the preceding volume.

These two volumes contain the descriptions and illustrations of all the well-known and determined species of Lamellibranchiate shells from the Upper Helderberg, Hamilton, Portage and Chemung groups, which formations are recognized as belonging to the Devonian System; together with a small number of species from the Waverly sandstone, and rocks of corresponding age, which are generally regarded as Lower Carboniferous. A few others have been introduced for the sake of comparison, or to show the distinguishing features of certain genera. The comparatively few species illustrated from the Waverly group are not to be considered as affording full means of comparison with the fauna of the groups below.

In commencing this work, the author had conceived the plan of bringing together illustrations of all the authentic and well-established genera of Palæozoic Lamellibranchiata; both in order to show the relations of those

already published with the newer work, and especially to render the volume more useful for reference and comparison, since much confusion has existed regarding generic relations.

The original plan, as thus proposed, cannot now be carried out, owing to the many delays which have come from extraneous sources, and the serious interference of other duties not contemplated at the time of its inception; and more especially the interruption of the progress of the work for many years and its revival under limitations precluding the employment of the time and means necessary for the acquisition of material required for the proper illustration of the subject. Moreover, the types of many of the genera are widely distant, and could only be made available by visiting the museums or collections in which they are preserved.

The author, therefore, finds himself obliged to publish the work in its incomplete condition; trusting that what has been accomplished may prove of assistance to those who follow him, and that it may stimulate some one, with better means for undertaking the work, to complete a monograph of the Palæozoic Lamellibranchiata.

The comparatively few species from the Waverly Group, given in this volume, with the more numerous forms elsewhere published from that horizon, and from the Carboniferous rocks above, give some idea of what might be obtained by systematic working in the upper palæozoic formations.

It was at one time the ambition of the author to accomplish this work; and it has been partly with this object in view that he has taken much pains to establish the line of demarkation between the Chemung and the succeeding Waverly Group; which limitation was not well understood when the present work was begun more than fifteen years since.

The remarks in the third to the seventh paragraph of the prefaces of the preceding volume are equally applicable to the present one. With the exception of a few plates, the work of lithography had been completed in 1876. While the work has been under revision, the plates added for the farther illustration of the genera Modiomorpha and Goniophora, are xxxv and xlii. The plates xciii–xcvi inclusive, were necessary for the illustration of new forms, and for

the correction or farther elucidation of forms already lithographed in the preceding plates.

Since that period, the material in the collections has received some accessions and a very careful examination. The genera and species have been critically studied and extensive revision has been made in the limitations of both. A careful examination of those species supposed to have a vertical range from the Chemung Group to the Waverly Group or the Burlington Yellow Sandstone, has shown that they are allied forms, but specifically distinct.

In many cases the differences are not strongly marked, but are constant and uniform, and are such changes as might very well come with the lapse of time, the slight change in the nature of the sediments, and the geographical relations of the localities. The genera prevalent in the Waverly Group are identical with those of the Chemung, and in all the collections which have come under observation, there are but four genera of Lamellibranchiata of the former group which are not also common to the Hamilton or Chemung.

The slow and gentle gradation of generic forms is well illustrated in the succession of strata from the Hamilton to the Waverly, and in no group so distinctly as in the Grammysidæ, as will be shown under the descriptions of genera in the following pages.

The nature of the sediments and the characters of the fauna from the beginning of the Hamilton Group to the close of the Waverly give evidence of gradually encroaching dry land on the eastward, or shallow sea, and off-shore deposits. This condition culminated in the eastern area by the great accumulation of the coarse sediments of the Catskill Group.

The conditions of preservation of the Lamellibranchiate shells rarely admit of the study of their interior structure, and the external form and sculpturing must be relied upon to a great extent in the determination of generic relations. It has happened, however, in a considerable number of forms, that we have been able to obtain illustrations of the hinge characters, leaving no doubt of the relations of the fossil. In many cases the surface sculpturing is so distinct and peculiar that we may group the forms together without hesitation.

In the progress of the work to its final revision, it has been found necessary

to indicate a considerable number of new generic forms, which it is believed are well founded in nature, and which will prove useful in the study of this class of fossils. The total number of genera described in the volume is sixty-five, of which twenty-six are new to science. Thirteen of these belong to the Monomyaria and thirteen to the Dimyaria.

The total number of species described is five hundred and twenty (520), of which two hundred and thirty-eight (238) belong to the division Monomyaria, and two hundred and eighty-two (282) to the Dimyaria. Four hundred and eighty-five (485) of these species belong to the Devonian System, as at present recognized. Thirty-five are from the Waverly or Lower Carboniferous, and five Silurian species are introduced for the purpose of comparison. The former volumes of the Palæontology contain altogether descriptions and illustrations of about twenty genera and one hundred species of Lamellibranchiata.

In the revision of the species, and the publication of this volume, the author acknowledges with great satisfaction the assistance rendered by Mr. C. E. Beecher. The original drawings of the fossils have been chiefly made by Mr. George B. Simpson. About twelve plates are by Mr. Emerton, and four by Mr. J. W. Hall; the supervision of the drawing and lithography was in charge of Mr. R. P. Whitfield. The six plates of recent additions have been drawn by Mr. E. Emmons. The lithography has been done chiefly by Mr. Philip Ast and Mr. Paul Riemann.

The author has been indebted for the use of specimens for illustration in this volume to the late Dr. James Knapp, of Louisville, Kentucky; to Prof. J. S. Newberry and Prof. J. J. Stevenson, of New York; to Mr. C. E. Beecher, of Albany, and for the loan of specimens from the collections of the Cornell University. Prof. Winchell, of Ann Arbor, has kindly loaned the types of all his described species from the Marshall Group and Burlington sandstones, of which farther use would have been made in comparisons with New York forms, but for the fact that he intends soon to publish the descriptions of the same with full illustrations of the species.

ALBANY, *November*, 1885.

INTRODUCTION.

The fossil Lamellibranchiata, of the higher groups of the New York geological series, are often very abundant, of great variety of form, and extremely interesting to the student, when once he has acquired a moderate degree of knowledge regarding their general character and their relation to existing forms. The study of this class of fossils in New York was begun more than forty-five years since by Mr. T. A. Conrad, who was commissioned as Palæontologist of the New York Geological Survey in 1837, and our earlier knowledge of these fossils is almost wholly due to him through his publications in the Annual Reports of the New York Geological Survey and the Philadelphia Academy of Natural Sciences.*

In his first Annual Report, "on the Palæontological Department of the Survey," published in 1838, Mr. Conrad described eleven species of Lamellibranchiate shells. During the following years, until 1842, this work was continued, both in the Annual Reports of the Survey and in the Journal and Proceedings of the Academy of Natural Sciences of Philadelphia. The total number of species described by Mr. Conrad, from all the formations from the Trenton limestone to the Waverly group inclusive, is about one hundred and ten, and fifty of these have been illustrated in the publications of the Academy. The number of species at present known and described from the same forma-

* Mr. Conrad had already, in 1835, published descriptions and figures of some palæozoic forms, including a single pectenoid species from the coal measures of Pennsylvania.

In 1820, Professor Amos Eaton notices the occurrence of Lamellibranchiata in the New York System in his "Index to the Geology of the Northern States," etc , pp. 76–81. No distinct species are referred to.

In 1824, Dr. J. E. De Kay (Annals of the New York Lyceum, vol. I, p. 45, pl. 5,) published a "NOTE *on the Organic Remains, termed* BILOBITES, *from the Catskill Mountains*," recognizing these fossils as probably the "moulds or casts of an extinct species of Cardium." These were probably the earliest notices of any fossil bivalve shells from the palæozoic rocks of New York.

tions, within the same area, is more than six hundred (600), of which about five hundred (500) are from the rocks above the Oriskany sandstone.

In 1842, Mr. Conrad having resigned his position as Palæontologist of the Survey, without making any final Report, the Geologists were left to their own resources in providing illustrations of the characteristic fossils of the formations within their several districts. The final Reports of the State Geologists, therefore, will be found to contain illustrations of a considerable number of the Lamellibranchiata.

During the interval named, and for many years subsequently, the writer, both personally and by the aid of his assistants, made extensive collections of this class of fossils in the State of New York, and to a less extent in other States.

At a still later period, from 1856 to 1870, extensive collections were made preparatory for the Palæontology of the State, through the means afforded by appropriations of money by the Legislature.

In making preliminary studies of these fossils, the author found that the types of Mr. Conrad's species were to a great extent inaccessible, or were distributed through the collections of several institutions, and of private individuals. In order to secure accuracy in the identification of the described forms, he availed himself of the assistance of Mr. Conrad for the study and comparison of all the species. On three several occasions Mr. Conrad spent a considerable time in Albany, in the study of the collections here accumulated; and in the identification and determination of species, labeling one or more specimens of those which he recognized as typical forms of the species he had previously described. In this manner, and by later studies and comparisons, it is believed that proper identification has been made with nearly all the described forms, and due credit has been given in this work.

From the time Mr. Conrad ceased his publications upon the Lamellibranchiata, numerous writers have published descriptions and illustrations of American species of this class of fossils, until at the present time the entire number of palæozoic species recorded is more than twelve hundred and fifty.

The principal authors, who have contributed to our knowledge of the subject, are given below in alphabetical order. To cite the date and title of the pub-

lications of each one, would occupy more space than the author has at his command in this introduction; and moreover, few of these writers have published species from the State of New York.

The following authors have published descriptions of species of American Palæozoic Lamellibranchiata:

Billings.	Hinde.	Salter.
Castelnau.	James.	Shumard.
Clarke.	Lea.	Stevens.
Conrad.	Marcou.	Swallow.
Cox.	Marcy.	Ulrich.
Dawson.	McChesney.	de Verneuil.
Dyer.	Meek.	Vanuxem.
Emmons.	Miller.	Walcott.
Gabb.	Morton.	White.
Geinitz.	Newberry.	Whitfield.
Hall.	Nicholson.	Williams.
Hartt.	Owen.	Winchell.
Haughton.	Pitt.	Worthen.
Hayden.	Safford.	

During a long interval, after the close of Mr. Conrad's labors, very little was done in New York beyond the accumulation and study of collections, and the determination of specific forms for the illustration of the New York Devonian Lamellibranchiata.

In 1869, the writer published "Preliminary Notice No. 2 of the Fossil Lamellibranchiate Shells of the Upper Helderberg, Hamilton, Portage and Chemung Groups," etc., to the number of eighty pages, which were issued in December of that year, and one hundred copies in this form were distributed. In January following the printing was resumed, and sixteen additional pages were printed. The pamphlet thus augmented, together with a supplementary page, stating the fact that the descriptions of other species were then in type,

was distributed to the public.* Since that time, the author has had no opportunity of completing the printing according to the original plan of the work.

This Preliminary Notice was originally prepared for incorporation in the 23d Report of the State Museum of Natural History, but it was published in advance, as a separate pamphlet, and has never been incorporated in any Report of the State Museum. The species there described have been included in the present and preceding volume with proper reference to the original publication.

The Preliminary Notice of the Lamellibranchiata No. 1, including the Monomyaria, was communicated with the 34th Report of the State Museum of Natural History, but was only published in the 35th Report, issued in 1884.

This paper, with plates giving generic illustrations, has been published in a separate form, making a pamphlet of about 200 pages with five lithographed plates of generic illustrations.

There are very few forms of Lamellibranchiata known in the primordial zone, nor until we reach the Chazy and Trenton periods are the fossils of this class found in any considerable number. In volume I of the PALÆONTOLOGY OF NEW YORK, there are but two species described from rocks below the Trenton limestone. Twenty-six species were described from that formation, and in the Utica slate and Hudson-river group, fourteen species were recognized. Later collections have largely increased the number, and it is not improbable that a study of the material since accumulated from the same localities will show double the number then known. So far as observed, the individuals of species in the Trenton limestone are not abundant, a few forms only having been collected in considerable numbers.

The species are more common in the limestones where there is considerable argillaceous matter, either intimately mingled with the calcareous mass, or when the calcareous layers are separated by argillaceous seams; and the fossils are usually casts of the interior, the shells being rarely preserved.

In the Hudson-river group, within New York, the species of this class, while

*The printing was discontinued at this point, page 96, owing to the burning of the printing office with all the matter in type except the stereotyped plates.

fewer than in the Trenton limestone, are more numerous as individuals, and make a much more conspicuous feature of the formation than they do in the Trenton limestone.

In the Trenton limestone, at Ottawa, in Ontario, the shells of the Lamellibranchiata are replaced by silica. This condition of the fossil enabled Mr. Billings to remove the calcareous matter by acid and determine the hinge-structure of several forms which were before unknown. In the Canadian Reports, this author has recognized a single species from the Calciferous sandstone and four species from the Chazy limestone. From the Lower Silurian (as then understood), he has published thirty-two new species, or a number nearly equal to all which had before been known to the public from the same rocks. He has likewise recognized, in the Canadian rocks, a large proportion of the species known in the New York formations of the same age.

The Trenton and lower limestones in their westerly extension are not more prolific in species of Lamellibranchiata than the same rocks to the eastward; but many new forms appear in the western localities. In this respect, however, the Hudson-river group forms a striking contrast with the same formation in the east. With the increase of calcareous matter in its composition, as traced in a westerly and north-westerly direction, the fauna becomes more abundant, and finally, in its greatest development, is more prolific in some classes of invertebrate fossils than any other of the palæozoic formations. With this general development the Lamellibranchiata keep pace, and the number of species described from this group in Ohio, Kentucky and Tennessee, and other western localities, far exceeds all that have been described from all the Eastern States. The entire number of species from this group, enumerated in Miller's Catalogue, is eighty-seven.

In the succeeding sedimentary formations of the Medina sandstone and Clinton groups of New York there are few species of this class of fossils; and the number in the calcareous measures constituting the Niagara group is scarcely greater. In the PALÆONTOLOGY OF NEW YORK, vol. II, twenty-seven species are described, of which two are from the Medina sandstone and nine from the Clinton group, leaving the remainder (including those from the Coralline lime-

stone and from the Guelph limestone), sixteen species, which are of Niagara age.

In the western extension of the Niagara group, the magnesian calcareous beds of the north-west have furnished a considerable addition to the number of species known in eastern localities; while the more southerly exposures of the shaly calcareous beds of the group in Indiana have furnished others which are quite unlike either the New York, or the Wisconsin and Iowa species. The Niagara of Tennessee has afforded little information in regard to the Lamellibranchiate fauna of that period.

From the calcareous and shaly measures of the Lower Helderberg group, in New York, there were described, in the PALÆONTOLOGY OF NEW YORK, vol. III, thirty-four species, and five species peculiar to the Oriskany sandstone. The exposures of the same formation in the south-west have added little to our knowledge of this class of fossils: though it is probable that many more species will be found on careful investigation.

Rocks of the same age as the Lower Helderberg and Oriskany in eastern Canada have afforded a considerable number of additional species, which have been described in the Canadian Geological Reports.

Succeeding the Oriskany sandstone, which is usually considered as the line of demarkation between the Silurian and Devonian systems, we find the Upper Helderberg group with a moderately developed Lamellibranchiate fauna.

In the middle Devonian, including the Hamilton, Portage and Chemung groups, this fauna for the first time in the geological history of the palæozoic formations in the State of New York, forms a conspicuous feature, both in number of species and abundance of individuals.

In the eastern and central counties of the State, the fossils of this class are distributed through more than one thousand feet in thickness in the sedimentary strata of the Hamilton group. These forms gradually diminish in number and abundance as the formation becomes more calcareous in its western extension, and the arenaceous sedimentary portions gradually become attenuated or altogether disappear, giving place to fine calcareous shales, which are not favorable to the development of this class of organisms.

The continuance of this fauna is almost entirely interrupted by the coming in of the Genesee slate and the Portage shales and sandstones in central and western New York, and is abruptly terminated in the eastern part of the State by the sedimentary accumulation of the Oneonta sandstone.

The Portage group, in some of its typical localities, carries a few forms of Lamellibranchiate shells, some of which, so far as we now know, have no generic relations with the prevailing forms above or below this horizon.

The genus Panenka and Lunulicardium, as well as the cosmopolitan form Glyptocardia, also occur in the Portage group. Thus far the pectenoid or aviculoid forms are not known in the rocks of this age, but our knowledge is not yet sufficient to speak positively of its entire fauna. Moreover, the western extension of this group has not been satisfactorily determined, and we are unable to present any facts regarding the distribution of species of that age beyond the State of New York.

Following the final deposition of the two latter formations, the Lamellibranchiate fauna reassumes its prominence under a somewhat modified aspect. A few of the forms which were predominant in the Hamilton group have become subdued in force, while others are augmented. Among the Monomyaria, there is a notable increase in the number of pectenoid and aviculoid forms, especially of Pterinea and Actinopteria.

In the formations below the Chemung, the genus Leptodesma is represented by two species, while the total number described is fifty-seven. Leiopteria, on the other hand, shows its greatest development in the Hamilton group. Pteronites proper is unknown below the Chemung, and the genus Ptychopteria, with its twenty-two species, is also unknown below that horizon.

Among the pectenoid forms there is a larger number of species of Pterinopecten below the Chemung, while Crenipecten, with its eight species in the Chemung group, is also unknown to us in any lower formation.

The genus Glyptodesma, so abundant and varied in form in a single species in the Hamilton group, is at present unknown in any higher formation.

Pterinea flabella, beginning its existence at the horizon of the Corniferous

limestone, becomes very abundant and varied in form in the Hamilton group, reappearing in considerable numbers, and acquiring very extravagant forms in the Chemung group.

The genus Grammysia, so abundant and characteristic in the Hamilton group, is far less conspicuous in the Chemung group, gradually losing its characteristic features to such a degree that it becomes a question with regard to some forms whether they shall be referred to Grammysia or Allorisma.

At the base of the Upper Helderberg group, the Scholarie grit carries a few species of this class of fossils which are peculiar to that rock. A considerable number of species make their appearance for the first time in the Corniferous limestone; and some of these are continued into the Hamilton group. A few species in this rock are remarkable for their persistence. The *Aviculopecten princeps* of Conrad is known in this horizon in New York, Ontario, Ohio and Indiana.

The Hamilton group in its western extension becomes a calcareous formation, and is represented in Wisconsin, at the Falls of the Ohio, and at other places, by a magnesian limestone, with more or less shaly matter interspersed throughout the mass, or intercalated in thin laminæ. At the Falls of the Ohio, the Hydraulic beds, which are equivalent or representative of the Hamilton group, contain at least twenty species of Lamellibranchiata, ten of which are likewise common to the Hamilton group in New York.

On the Mississippi river, the Hamilton group is represented by a limestone carrying many of the characteristic fossils (especially Brachiopoda) of the formation in its eastern development.

The Chemung group in its lower members is more restricted in its geographical distribution than the Hamilton group. Its central and upper members, have a wider expansion than the lower beds, and everywhere carry a peculiar and characteristic Lamellibranchiate fauna. Some of the genera common to the Hamilton group disappear almost entirely, while many new forms come in above the Portage; and several genera first appearing in lower horizons, here reach their greatest development in number of species.

In the lower members of the group, as at Ithaca, and adjacent localities, a

notable number of Hamilton species recur, but in nearly all cases they appear in a pauperized condition, as if the sediments were unfavorable to their growth and development. The fauna of the group, as developed at Ithaca and vicinity, is comparatively limited in geographical extent, being interrupted on the east by the influx of coarser sediments, and, so far as observed, the strata soon thin out on the west, or are merged in beds above and below, losing any distinctive faunal character which may mark the formation in its central development.

A considerable number of species occur in this part of the group, which do not pass above that horizon, and it was from this fact, and also from the recurrence of lower forms in the same strata, that Mr. Vanuxem proposed to designate the formation as the Ithaca group. There are difficulties attending such a separation and distinction, since there is yet no well-recognized limitation between the fossiliferous beds of Ithaca and the Portage below, and, on the other hand, it has not been shown that this formation is distinctly separated from the typical Chemung lying above, and which has a great development in Chemung and adjacent counties.

The Lamellibranchs most characteristic of the central part of the group, are several species of Leptodesma and Pterinea, which are abundant in the valley of the Chemung river and in numerous localities in the same horizon.

The upper members of the Chemung series are in general well marked and characterized by the abundant presence of *Spirifera disjuncta*=*S. Verneuili*, which is common to the various beds of shale, flags, slates, sandstones, conglomerates and calcareous bands found in the upper part of this group; but the Lamellibranchiate fauna has no such general or uniform distribution.

These fossils occur in small assemblages of species and genera, and are very circumscribed in extent, as if their duration or continuance was limited to each change in the sediments, which were apparently deposited in shallow pools or small areas over the sea bottom. This at least is the present aspect of the question, and we can only await more extended and critical examinations of the exposures of these strata before propounding any other solution of the problem.

In some localities we have the most positive evidence that the sediments have been deposited in circumscribed areas, as in the case of the Panama conglomerate and the Salamanca sandstones, and in these examples we have a peculiar and restricted fauna.

In its far western extension the Chemung group has become a calcareous formation, bearing many of the characteristic forms of Brachiopoda and but few of the Lamellibranchiata so characteristic of the group in the east.

The Waverly sandstone and its equivalent or representative formations in the west, have not yet been studied with that degree of care and comparison, over wide areas, which are sufficient to warrant generalizations regarding the distribution of the Lamellibranchiate fauna. The species described from widely separated localities are a sufficient evidence that the conditions for the development of such a fauna have existed over a wider extent than in previous periods of geological history.

In the process of sedimentation and the imbedding of the shells of this class, the valves have, for the most part, been separated; and the inner surface adhering to the rock, it becomes very difficult to ascertain the hinge structure, a character which should be the basis of generic distinction in fossils of this class.

In far the larger proportion of the specimens of the Lamellibranchiata obtained from the rocks of New York, the shells have been macerated or dissolved to such a degree that we have barely a film remaining which preserves the external markings, or, in some species, the characters of the interior are visible without having the exterior markings of the shell entirely destroyed. Many of the shells are extremely thin, but some of the stronger forms, in certain conditions of the matrix, have the shell well preserved. In these forms we have often well-marked casts of the interior, and rarely we may obtain the exterior shell in such condition as to show its entire characters.

In the study of the species of this class of shells it is not always possible to determine the changes in form and expression, which may be due to physical influences, and in some degree also to the chemical effects operating upon the enclosing matrix.

In the gradual dessication and hardening of the soft muds in which the shell was originally imbedded, extreme changes in form are sometimes wrought, as is more distinctly shown where two valves held in connection by the ligament, one has been imbedded horizontally, retaining essentially its original form, while the other, imbedded vertically, or with its basal margin downward, is narrowed by the vertical pressure to a degree which leaves it quite unlike in form to the corresponding attached valve, as has been shown in a few illustrations in this volume. Where such influences are exerted upon single disconnected valves we have no means of knowing the degree of distortion produced except by comparison with other valves recognized as of the same species. Shells which in their original condition may have been convex or even gibbous, have become flattened by the pressure, especially in the thinly laminated beds; and unless found under more favorable conditions, their true proportions may not become known. A slightly oblique pressure may change the position of the beaks relative to the anterior or posterior extremities of the shell without distorting the general form. The general outline of the shell may also suffer from very slight movements of the solidifying matrix.

The surface markings may become more or less obliterated and sometimes modified by a covering of very fine sand which adheres to the shell. The sharpness of the surface striæ is frequently subdued or nearly obliterated by maceration, or from the presence of iron pyrites, where decomposition leaves the resulting acid to attack the prominent portions of the surface and thus modify or destroy the exterior characters.

Through the influence of such modifying conditions it may often happen that characters which are regarded as of importance in the living shell may be obscured or obliterated during the process of fossilization.

Considering the effect of all these influences, it often requires great care to determine what are really specific distinctions, and what modifications may be due to extraneous causes. With a small number of individuals, derived from one or two localities, it may not always be possible to make the proper discrimination. The true determination of the limits of species in this class of fossils

is always attended with difficulty from the causes named, and the influence of individual judgment should always be considered.

In order, therefore, to avoid erroneous conclusions regarding the real characteristics of these fossil shells, it becomes necessary to acquire extensive collections, not only from one or a few localities, and a single condition of the rock, but from numerous and widely separated localities, and from the rock in all its phases of composition and conditions of deposition.

SYNOPSIS OF THE GENERA INCLUDED IN THIS VOLUME.

Modiomorpha, Hall (Preliminary Notice Lamellibranchiata, 2, p. 72. 1870). [Type, Pterinea concentrica, Conrad.]

Shell equivalve, very inequilateral, sub-ovate in outline, largest posteriorly. Anterior end rounded, forming a projecting lobe of greater or less extent beyond the beak. The valves are crossed obliquely by a more or less distinctly defined cincture passing from the beak to the base, and constricting the basal margin. Beaks small, compressed.

Surface of the shell marked by rugose or undulating concentric striæ.

Hinge furnished with a strong wedge-form tooth in the left valve and a corresponding cavity in the right. No lateral teeth have been observed. Ligament external, attached to the thickened margin of the shell, which is often longitudinally grooved for its reception. Anterior muscular impression situated within the anterior extension of the shell. Posterior impression large and superficial, situated on the posterior slope. Pallial line simple.

Examples: *Modiomorpha concentrica*, pl. xxxvi, figs. 1–18.
Modiomorpha mytiloides, pl. xxxviii, figs. 1–16.

Goniophora, Phillips (Memoirs Geol. Surv. Gt. Britain, vol. ii, pt. 1, p. 264. 1848). [Type, Goniophora cymbiformis, Sowerby, sp.]

Shell equivalve, very inequilateral, rhomboidal or trapezoidal in outline, obliquely truncate behind and rounded in front. Cardinal line usually straight and not oblique. Beaks small, closely incurved, situated within or about the anterior third of the shell. Umbo prominent. Umbonal slope continued as a

strong angular ridge to the post-inferior margin. The valves are crossed obliquely, sometimes vertically, by a broad undefined sinus extending from anterior to the beaks to the basal margin, which is usually slightly constricted at this point.

Surface marked by more or less regular concentric striæ, which may be either simple throughout or fasciculate on the anterior portion of the shell. Some species are marked by strong radiating striæ upon that portion of the valves between the umbonal ridge and the sinus.

Hinge furnished with a strong oblique fold or tooth in the left valve, situated just beneath the beak, and a corresponding depression in the right valve. No lateral teeth have been observed. Ligament external, strong; its attachment to the shell is marked by one or more defined grooves. Muscular impressions, two; the anterior one deep and strongly marked, situated a little anterior to the beak and just within the anterior margin. Pallial line simple, continuing nearly parallel to the basal margin until it crosses the umbonal ridge, and recurving to the posterior muscular impression which is large and shallow, and situated on the posterior cardinal slope sometimes near the middle of the length of the shell.

This genus was proposed by Phillips * in 1848 as a generic designation for the original *Cypricardia cymbiformis* of Sowerby, but without generic definition or illustration of internal characters, and so far as known, the genus has never been heretofore described.

The shells here referred to *Goniophora* have similar internal characters with *Modiomorpha*, the external form and especially the strong umbonal ridge being the principal distinguishing features. This generic form occurs in the Trenton limestone, Niagara group, Schoharie grit, Hamilton and Chemung groups.

Examples: *Goniophora perangulata*, pl. xxxiv, figs. 1–6.

Goniophora Glaucus, pl. xliv, figs. 10–17.

* Memoirs Geol. Surv. Gt. Britain, vol. 2, pt. 1, p. 264. "If, as I suppose, *Cypricardia cymbiformis* be distinct, generically, and include species of the mountain limestone, the name *Goniophora* seems suitable. It is, however, doubtless, a mytiloid shell."

Microdon, Conrad (Journal of the Academy of Natural Sciences, Philadelphia, vol. viii, p. 247. 1842). [Type, Microdon bellistriata, Conrad.]

Shell equivalve, inequilateral, transversely sub-elliptical or sub-quadrate in outline. Cardinal line straight or slightly arcuate. Anterior end narrowed and rounded. Posterior extremity broad and truncate. Beaks small, pointed, appressed, situated nearer the anterior end. Umbonal ridge more or less defined, extending from the beaks to the post-inferior angle.

Surface marked by more or less rugose and regular concentric striæ.

Hinge characterized by a triangular tooth in each valve, that of the left valve short and situated beneath the beak, with a more elongate pit or groove behind it for the reception of the tooth of the right valve. The right valve has also a triangular pit beneath the beak for the reception of the short tooth in the left valve, and a longer triangular fold behind, which is sometimes double. No lateral teeth have been observed, unless the long oblique fold of the right valve be regarded as a lateral tooth. Ligament external, extending almost or quite the entire length of the cardinal line. Anterior muscular impression moderately large, sub-circular or short reniform; posterior scar superficial. Pallial line simple.

Owing to the fact that the name *Microdon* had previously been established by Agassiz for a genus of fishes, the name *Eodon* was proposed by Hall and *Microdonella* by Œhlert. The genus *Cypricardella* (Trans. Albany Inst., vol. iv. 1856) has been shown to be identical with *Microdon.** If the name *Microdon* is to be suppressed, the name *Cypricardella* will have precedence. *Microdon* is retained for the present, using the genus *Cypricardella* parenthetically.

Examples: *Microdon* (*Cypricardella*) *bellistriatus*, pl. lxxiii, figs. 7–22; pl. lxxiv, figs. 5–10.

Microdon (*Cypricardella*) *tenuistriatus*, pl. lxxiii, figs. 23–30; pl. lxxiv, figs. 20, 21.

* R. P. Whitfield. Bull. Am. Mus. Nat. Hist., vol. i, No. 3, p. 63. 1882.

Nucula, Lamarck (Hist. An. Sans. Vert. 1799).

Shell small, equivalve, inequilateral, trigonal or transversely elliptical or sub-circular. Anterior or posterior extremity sometimes produced, usually rounded. Beaks anterior or posterior to the middle of the length, often sub-central. Cardinal line arcuate. Escutcheon marked.

Surface marked by concentric striæ, which, in some species, are regular and rugose.

Hinge furnished with a triangular, spoon-shaped cartilage-pit beneath the beaks, with a series of small transverse teeth on each side. There are two principal muscular impressions in each valve, with usually a smaller retractor scar adjacent, and also the cavity of the beaks often shows several pits for the attachment of umbonal muscles. Pallial line simple.

Most of the species described in this volume have the beaks anterior to the middle. One species, *N. lamellata*, shows the beaks posterior to the centre, but in a few specimens of this species it is sub-central.

Examples: *Nucula Randalli*, pl. xlv, figs. 6–10, 16, 23, 26, 27; pl. xciii, figs. 1–3.
Nucula varicosa, pl. xlvi, figs. 12–23.

Nuculites, Conrad (Geol. Surv. N. Y., Ann. Rep., p. 49. 1841).

[Types, Nuculites oblongatus, Conrad, and Nuculites cuneiformis, Conrad.]

Shell equivalve, inequilateral, transverse. Anterior end rounded. Posterior end sometimes obliquely truncate and pointed. Beaks anterior. Cardinal line arcuate. Post-umbonal slope rounded or angular.

Surface marked only by concentric striæ in all the known species.

Hinge furnished with a row of transverse narrow teeth, beginning at the anterior muscular scar and extending without interruption posteriorly as far as the posterior scars. Ligament external, contained in a narrow groove along the margin of the hinge. Anterior muscular scar deeply impressed, separated from the cavity of the shell by a vertical or slightly oblique clavicle, or partition, extending about two-thirds the distance from the beak toward the base. Posterior scar elongate, situated just below the termination of the hinge

crenulations. Just anterior to the posterior adductor are one or two small retractor impressions. The cavity of the umbo also usually shows three or four impressions of umbonal muscles. Pallial line simple.

This genus differs very distinctly from *Nucula* in the anterior clavicle and absence of cartilage-pit.

Examples: *Nuculites oblongatus*, pl. xlvii, figs. 1–12.
Nuculites triqueter, pl. xlvii, figs. 17–28.

Leda, Schumacher (Essai, p. 172, pl. xix, fig. 4. 1817).
[Type, Arca rostrata, Chemn.]

Shell equivalve, inequilateral, transverse, often lunate, produced behind and rostrate. Anterior end rounded. Beaks often turned toward the posterior. Post-umbonal slope defined, extending from the beak to the posterior extremity, and often forming a nasute extension.

Surface marked by more or less regular concentric striæ.

Hinge furnished with a line of minute teeth which is interrupted at the beak by the triangular cartilage-pit. Muscular impressions two, small. Pallial line simple or with a very slight sinus.

Examples: *Leda brevirostris*, pl. xlvii, figs. 38–41.
Leda rostellata, pl. xlvii, figs. 42–47.
Leda pandoriformis, pl. xlvii, figs. 49, 58.

Palæoneilo, Hall (Prelim. Notice Lamellibranchiata, 2, p. 6. 1870).
[Type, Nuculites constricta, Conrad.]

Nuculiform shells, transversely ovate or sub-elliptical, the posterior end extended, often sub-rostrate, with a more or less defined sulcus along the umbonal slope. Cardinal line arcuate.

Surface marked by striæ of growth, which are often lamellose and elevated into concentric ribs.

Hinge furnished with a row of regular small transverse teeth, which is somewhat interrupted beneath the beak by a change in the direction of the teeth,

or by several oblique teeth.* Ligament external, contained in a shallow and narrow groove along the cardinal border. Muscular scars not strongly impressed, situated below the extremities of the hinge-line. Pallial line simple.

This genus differs materially from *Nucula*, *Leda* and *Yoldia*, in the absence of a cartilage-pit beneath the beaks; in having an external ligament and a sulcus on the post-umbonal slope. It differs from *Nuculites* in form, and in the absence of a clavicular ridge on the anterior end. In general form and internal characters this genus very closely resembles *Tellinomya*, and it is probable that further study will prove that the two are congeneric.

Examples: *Palæoneilo constricta*, pl. xlviii, figs. 1–16.
Palæoneilo fecunda, pl. xlix, figs. 13, 15–24.
Palæoneilo attenuata, pl. l, figs. 34–39.

Macrodon, Lycett (Murch. Geol. Chelt.).

Shell equivalve, inequilateral, transverse, sub-elliptical, or sub-ovate in outline. Anterior end angular at the cardinal line, rounded below. Posterior end rounded or obliquely sub-truncate. Beaks anterior to the middle. Cardinal line long and straight.

Surface marked by concentric striæ which are often regularly laminose, and in some species by fine radiating striæ.

Hinge furnished with several (sometimes eight) small diverging teeth beneath the beak and by from two to four lateral teeth situated near the posterior extremity of the cardinal line. Ligament external. Muscular impressions not strongly marked. Pallial line simple.

Examples: *Macrodon Hamiltoniæ*, pl. li, figs. 1–7, 9, 10.
Macrodon Chemungensis, pl. li, figs. 11–16.

* The hinge characters of this genus and the resemblance to the genus *Neilo* were first indicated to me by Mr. R. P. Whitfield.

Ptychodesma, Hall and Whitfield (Twenty-fourth Ann. Rep. N. Y. State Museum Nat. Hist., p. 192. 1872).

[Type, Ptychodesma Knappianum, Hall and Whitfield.]

Shell equivalve, inequilateral, obliquely sub-ovate. Anterior end short, more or less defined by a shallow cincture extending from the beak to the base. Posterior extremity broadly rounded. Cardinal line short, nearly straight, often arching. Umbonal slope rounded.

Surface marked by concentric striæ of growth.

Hinge with two or more cardinal teeth and a wide and deeply excavated ligamental area, the sides of which are sharply grooved in parallel lines. The grooves and ridges are slightly arched beneath the apex of the valves where they take their origin. Anterior muscular impression strong.

Example: *Ptychodesma Knappianum*, pl. li, figs. 22–27.

Nyassa, Hall (Preliminary Notice Lamellibranchiata, 2, p. 27. 1870).

[Type, Nyassa arguta, Hall.]

Shell equivalve, inequilateral, transversely elongate or sub-elliptical. Beaks small, usually appressed, situated near the anterior end. Cardinal line long, arcuate. The middle of the shell is often marked by an oblique cincture, which produces a constriction in the margin. Umbonal ridge more or less defined, extending to the post-inferior extremity.

Surface marked by concentric lines of growth, and in some species by obscure radii.

The anterior end of the hinge-plate is furnished with a number of irregular teeth or plications in the young stages, which become more or less thickened and coalescent with age. Posteriorly, the hinge is marked by from one to four elongate lateral teeth. Ligament external, inconspicuous. Anterior muscular scar strong and deep. Posterior scar larger and faintly marked. Pallial line simple.

Examples: *Nyassa arguta*, pl. liii, figs. 7–20.
Nyassa subalata, pl. liii, figs. 21–26.

Grammysia, De Verneuil (Bull. Soc. Geol. France, 2d ser., vol. iv, p. 696. 1847).

[Type, Grammysia Hamiltonensis, De Verneuil, 1847 = Pterinea bisulcata, Conrad. 1838.]

Shell equivalve (with the exception of the alternation of the cincture and fold in the two valves, which produces a slight inequality), inequilateral, transversely elliptical or sub-ovate. Margins closed. Beaks prominent and incurved, situated anterior to the middle. Cardinal line straight or somewhat arcuate. Escutcheon and lunule well defined. Valves, in the typical forms, traversed from the beak to the base by an oblique cincture and adjacent fold, which may be duplicate, and are alternating in the two valves, sometimes producing a constriction and short extension of the ventral margin. Some species show the cincture developed in the upper part becoming obsolete before reaching the margin. Many forms show a broad cincture without an adjacent fold; and in some species the cincture is indicated by a line of slight interruptions or irregularities in the concentric undulations; other species have the surface continuous, without cincture or fold.

Surface marked by concentric striæ of growth, and often by strong concentric undulations. Many species also show fine pustulose radiating striæ.

Hinge-plate short and strong, with one or two thickened folds beneath the beak of some species. Ligament external, closely resembling that of *Unio*. Anterior and posterior muscular impressions faintly marked, the latter much the larger. Pallial line simple, often broken into pits and furrows.

The above description is emended to include cingulate and smooth forms. It has been found that the cincture is a very variable character even in the same species, and that no generic line can be drawn between species having a well-developed cincture and those in which this feature is obsolete.

This genus as properly limited will be found to include many species heretofore referred to *Allorisma*, *Sanguinolites*, *Orthonota*, *Chænomya*, etc.

Dr. L. G. de Koninck has lately (Faune Calcaire Carb de Belgique, pt. v, p. 4. 1885)* referred most of the species heretofore regarded as *Grammysia* to the

*The letter press of the descriptions of species of this volume was all in type before Dr. de Koninck's publication was received, and hence no references or comparisons of species could be made.

genus *Chænomya*, overlooking the fact that the type of *Grammysia* is a New York species, and has been made the basis of comparison of all the species published in the Preliminary Notice of the Lamellibranchiata and in the present volume; *Grammysia* has also a priority of seventeen years over *Chænomya*. A reference to the type of *Chænomya* (*C. Leavenworthensis*) will also show the marked differences between that form and those here referred to the genus *Grammysia*. *Chænomya* has the valves gaping behind as in the recent genus *Mya*, the pallial line is sinuate and the beaks are small and appressed.

Mr. J. W. Salter (Mem. Geol. Surv. Gt. Britain, pp. 359–361, 1848) considers *Grammysia* as a sub-genus of *Orthonota* and that *Allorisma* is a synonym of the latter genus. In accordance with this, he describes the species *O. cingulata*, Hisinger sp., *O. triangulata*, Salter, and *O. extrasulcata*, Salter, and notes their relationship with the species of *Grammysia*, as defined by De Verneuil.

The genus *Grammysia* seems to be well-founded in nature, and is quite distinct from *Orthonota*, although with our present knowledge it is difficult to clearly separate *Grammysia* from *Allorisma*, as now recognized, on account of the numerous intermediate species which seem to unite the two extremes of variation.

Examples: (*Section a. cingulata*) *Grammysia bisulcata*, pl. liv, figs. 1–16; pl. lvi, fig. 1; pl. xciii, fig. 25.

(*Section b. obsoleta*) *Grammysia obsoleta*, pl. lix, figs. 21–27.

(*Section c. undulata*) *Grammysia alveata*, pl. lvii, figs. 1, 2; pl. lx, figs. 1–11.

(*Section d. elongata*) *Grammysia communis*, pl. lxi, figs. 24–28; pl. xciii, fig. 21.

For convenience of reference and description, the species described in this volume have been arranged in the four natural groups as above indicated. The first group represents the typical form of *Grammysia*, while the last group includes species which have sometimes been referred to *Allorisma*, and may perhaps with propriety be included in that genus.

The generic description of *Allorisma* (King, 1844), as redefined (King, Perm. Foss., p. 196, 1850), is here given: "Equivalved: inequilateral, the posterior side being the longest: in general slightly gaping. *Valves* granulated on the

surface; more or less undulated or ribbed parallel to the free margins; and articulating with each other by means (only) of an external cartilage. *Anterior adductor muscular impressions*, in general, near the antero-ventral margin. *Sinus* deep in some species, and shallow in others."

"Type, *Hiatella sulcata*, Fleming."

In the volume of Plates and Explanations (1883), the name *Sphenomya* was proposed as a sub-genus of *Grammysia*, differing from that genus in its ovate-cuneate, oblique form, and absence of ligamental groove. It closely resembles the typical form of *Cuneamya*, but also differs in the absence of the ligamental groove. The name is at present confined to a single species.

Example: *Grammysia* (*Sphenomya*) *cuneata*, pl. lxii, figs. 1–9; xciii, fig. 19.

Euthydesma, n. g. [Type, Astarte subtextilis, Hall.]

Shell equivalve (?), inequilateral, broadly sub-ovate with a sub-alate cardinal expansion. Cardinal line rigidly straight. Anterior end short. Beaks sub-anterior.

Surface marked by concentric striæ of growth, and in the species described, by slender radiating striæ.

Hinge-line straight, and marked by a distinct, continuous ligamental groove.

But one species of this genus is at present known and its characters do not seem to ally it with any described form.

Example: *Euthydesma subtextile*, pl. lxiii, figs. 11–16; xciii, figs. 28, 29.

Edmondia, de Koninck (Anim. Foss. Carb. Belgique, p. 66). 1844.

Shell equivalve, oval or sub-circular. Beaks varying from sub-central to nearly anterior.

Surface marked by concentric striæ, and sometimes by obscure radii or fine radiating striæ.

Hinge narrow, without teeth. Ligament external, contained in a groove along the cardinal line. Muscular impressions not strongly impressed. Pallial line simple.

Examples: *Edmondia Philipi*, pl. lxiv, figs. 9, 11–14, 17, 29; pl. xcv, figs. 1–4.
Edmondia subovata, pl. lxiv, figs. 18–20, 26–28; pl. xcv, figs. 9–12.

Sphenotus, N. G. [Typical species, Sanguinolites arcæformis, Hall, and Cypricardia contracta, Hall.]

Shell equivalve, very inequilateral, elongate sub-trapezoidal or cylindrical in outline. Anterior end short. Posterior end usually obliquely truncate. Beaks sub-anterior. Cardinal line long and nearly straight. Umbonal ridge defined, extending from the beak to the post-inferior extremity. Post-cardinal slope marked in all the characteristic species by a median ridge. Valves crossed from the beak to the base by a more or less defined, broad cincture, which often produces a constriction in the ventral margin.

Surface marked by concentric striæ of growth, and rarely by fine radiating lines. In a single species (*S. solenoides*) the surface is further ornamented by fine, irregular, elevated vascular lines on the posterior half of the shell, especially above the umbonal ridge.

Hinge narrow, with two short, narrow cardinal teeth beneath the beak of the right valve, and with one or two extremely slender lateral teeth. Ligament external, contained in a slender groove along the cardinal line. Anterior muscular scar strongly marked, situated close to the anterior margin. Posterior scar shallow. Pallial line simple.

The species united under the preceding generic description have been referred to several genera by various authors. The genus *Sanguinolites*, by an unwarrantable extension of its true characters and the disregard of the type, has heretofore included many species of this group. Also, a few forms have been placed in the genus *Allorisma*. They differ from both these genera in the umbonal and post-cardinal ridges, their trapezoidal form, in the cincture crossing the valves, and in the characters of the hinge.

Examples: *Sphenotus arcæformis*, pl. lxv, figs. 7–11.

Sphenotus contractus, pl. lxvi, figs. 1, 3–9, 11–13, 15; pl. xciv, fig. 2.

Spathella, N. G. [Type, Spathella typica, Hall.]

Shell equivalve, very inequilateral, wider behind, transversely sub-cylindrical. Anterior end short, narrowly rounded. Beaks sub-anterior, small. Umbonal slope rounded or sub-angular.

Surface marked by concentric striæ, which are often more or less lamellose. Interior unknown.

The species referred to this genus were originally described as *Sanguinolites*. In the absence of a knowledge of their internal characters, they may be distinguished from *Sphenotus* by their elongate sub-cylindrical form, widest at the posterior end; want of defined umbonal ridge, with no fold on the post-cardinal slope. *Sanguinolites*, as illustrated and defined by McCoy, is synonymous in part with *Allorisma*, although the first species under the genus does not show this relationship.

The two species of *Spathella* described, in external form and markings, seem to be related to the *Lithophagi*, but can be referred to no known genus.

Examples: *Spathella typica*, pl. lxvi, figs. 36–40.
Spathella ventricosa, pl. lxvi, figs. 41, 42.

Conocardium,* Bronn (Lethæa Geognostica, vol. i, p. 92. 1835).
[Type, Cardium Hibernicum, Sowerby.]

Shell equivalve, inequilateral, more or less fusiform or trigonal. Posterior end obliquely truncate, produced along the cardinal line into a siphonal tube and sometimes the antero-inferior margin is also produced. Anterior end conical and gaping in front. Beaks prominent and strongly incurved. Ventral margins crenulated. Cardinal line straight. Umbonal ridge prominent and ornamented with an expansion of the test in continuation of the truncated posterior end.

Surface marked by concentric striæ, and usually ornamented with strong radii.

Hinge with anterior and posterior laminar teeth [Barrande]. Ligament external. Muscular impressions two in each valve, situated near the cardinal extremities. Pallial line simple. In the anterior end there is a thickening or internal process forming apparently a foot-sheath.

Examples: *Conocardium cuneus*, pl. lxvii, figs. 1–32; pl. lxviii, figs. 1, 4–16; pl. xciv, figs. 11, 12.
Conocardium normale, pl. lxviii, figs. 17–19.

* Dr. Lindström, of Stockholm, writes that he has been engaged in the study of *Conocardium*, by cutting numerous specimens, and finds that they have no relation to the Cardiadæ, a fact before suspected and believed by many persons, but never proved until the present time.

Panenka, Barrande (Syst. Sil. de la Bohême, pt. 1, vol. vi, p. 128. 1881).

Shell equivalve, more or less inequilateral, transversely or longitudinally elliptical or sub-circular. Beaks prominent and incurved. Cardinal line straight or arcuate. In some species there is a small triangular area beneath the beaks. Lunule sometimes present.

Test thin. Surface marked by lines of growth, and usually by well-developed radii. Interior unknown.

The species referred to this genus were formerly grouped under the genus *Cardiola*, from which they differ as shown by Barrande in their more expanded superior margins, and surface ornaments. Illustrations of a species of *Cardiola* (*C. fluctuans*, Barr.), are introduced on plates lxx and xciv, for comparison with the species of *Panenka* and allied genera.

Examples: *Panenka multiradiata*, pl. lxix, fig. 5; pl. xciv, fig. 18.
Panenka Lincklæni, pl. lxix, figs. 12–14.
Panenka radians, pl. lxix, fig. 9.
Panenka equilatera, pl. lxix, fig. 4; pl. xciv, fig. 17.

Glyptocardia, n. g. [Type, Venericardium retrostriatum, von Buch;=Cardium palmatum, Goldfuss;=Avicula speciosa, Hall.]

Shell small, equivalve, inequilateral, broadly elliptical or sub-circular. Beaks anterior to the middle, incurved.

Surface marked by strong radiating plications and by concentric striæ which are often lamellose and arching over the radii. Interior unknown.

The small shells for which this genus has been proposed, are. of very wide distribution, and have been referred by various later writers to the genus *Cardiola*, from which they differ in their expanded cardinal margins, their surface sculpturing, their minute size, and absence of a cardinal area beneath the beaks.

Example: *Glyptocardia speciosa*, pl. lxx, figs. 2–9; pl. lxxx, fig. 10.

Præcardium, Barrande (Syst. Sil. de la Bohême, pt. 1, vol. vi, p. 141. 1881).

Shell equivalve, more or less inequilateral, longitudinally or transversely elliptical or trigonal. Beaks prominent and incurved.

Surface marked by concentric striæ of growth, and by strong elevated radii, separated by distinct interspaces.

Posterior to the beaks is a small area which carries a series of vertical nearly parallel teeth. Other characters of the interior unknown.

The species of this genus differ from *Panenka* in the characters of the hinge, and from *Pararca* in form, surface markings, and in the cardinal area posterior to the beaks.

Example: *Præcardium vetustum*, pl. lxx, figs. 18–20.

The genus is represented in America, so far as known, by the single species cited above, occurring in the shales of the Portage group.

Paracardium, Barrande (Syst. Sil. de la Bohême, pt. 1, vol. vi, p. 137. 1881).

Shell equivalve, more or less inequilateral, sub-circular or broadly elliptical. Posterior side sub-truncate, resembling in this respect some broad forms of *Lunulicardium*. Valves moderately convex.

Surface marked by numerous fine radii with narrow interspaces, and by fine striæ of growth.

Under the beaks is a small cardinal area, the margin of which is minutely crenulated. Muscular scars and pallial line unknown.

The shells of this genus differ from those of the genus *Pararca* in the presence of a cardinal area. *Pararca* has a longer hinge-line and more extended line of crenulations, and the form is more transverse.

Example: *Paracardium Doris*, pl. lxx, figs. 10, 11.

Pararca, N. G. [Types, Pararca venusta, Hall, and Pararca erecta, Hall.]

Shell equivalve, inequilateral, transversely sub-elliptical or rhomboidal in outline. Posterior end often sub-truncate. Anterior end short and rounded.

Valves moderately convex. Cardinal line about half the length of the valve, arching at the beaks. Umbonal slope often defined.

Surface marked by more or less slender radii with narrow interspaces and by fine concentric striæ of growth.

Hinge narrow and long, furnished with a series of minute crenulations. Ligament apparently contained in a narrow groove along the cardinal border. Muscular impressions and pallial line unknown.

This genus is distinguished by the transverse form of the species, the surface characters and the crenulations of the hinge, although this feature has been seen but in a single species, probably on account of the specimens having been preserved in sandstones and arenaceous shales.

Examples: *Pararca venusta*, pl. xciv, fig. 22.
Pararca Sao, pl. lxx, fig. 17.
Pararca erecta, pl. lxx, fig. 16; pl. xciv, figs. 20, 21.

Cardiopsis, Meek and Worthen (Proc. Acad. Nat. Sci. Phila., p. 144. 1861).
[Type, Cardiomorpha radiata, Meek and Worthen.]

Right valve gibbous, inequilateral, obliquely ovate or sub-circular. Beak prominent, incurved. Cardinal line short.

Surface marked by radiating striæ or costæ, and concentric striæ of growth.

Hinge with one or two cardinal teeth. Ligament and muscular impressions unknown.

Although in the original description of this genus the valves are said to be equal, it is probable that the description was written from observations based upon right valves alone.

A comparison of specimens of this valve with the corresponding valves in the type-specimens of the genus *Dexiobia*, shows a great similarity in form and surface characters, and it is probable that the two may prove to be generically identical. Also the genus *Dualina* (Barrande, 1881) seems to be congeneric with *Dexiobia*.

Example: *Cardiopsis radiata*, pl. lxx, fig. 25.

Lunulicardium, Munster (Beiträge zur Petrefakten-Kunde, 3d heft, p. 69. 1840).

Shell equivalve, inequilateral, longitudinally or transversely sub-elliptical, sub-circular or trigonal. Posterior side obliquely truncate by the cardinal hiatus, with the margin often reflexed and produced. Beaks pointed, sub-central or anterior. Cardinal line marked by a lunate hiatus in each valve which was probably occupied by the ligament.

Surface marked by concentric striæ and usually by more or less well-developed radii with distinct interspaces. Some species also show a minutely pustulose character of the surface.

Ligament external, occupying the hiatus of the cardinal line.

Hinge, muscular scar and pallial line unknown.

Examples: *Lunulicardium curtum*, pl. lxxi, figs. 18–23.
Lunulicardium transversum, pl. xciv, figs. 24, 25.
Lunulicardium fragile, pl. lxxi, figs. 1–14.

Paracyclas, Hall (Geol. Surv. N. Y.; Report of the Fourth District, p. 171. 1843). [Type, P. elliptica.]

Shell equivalve, sub-equilateral, sub-orbicular or broadly sub-elliptical. Anterior end regularly rounded; posterior end rounded or sub-truncate, somewhat more produced below than the anterior; beaks small and low, generally rising little above the hinge-line.

Hinge-line short. Post-cardinal slope more or less defined by an oblique furrow or depression, which sometimes leaves the extremity sub-alate.

Surface concentrically striated; sometimes with strong concentric ridges marking the exterior.

Structure of hinge not fully observed. Ligament supported on each side, internally, by a narrow plate, and leaving in the cast two diverging grooves, directed forward from the beak. Muscular impression on the post-umbonal slope. Pallial line parallel with and a little within the margin of the shell.

This fossil possesses many of the external characters of the finely striated forms of modern *Lucina;* and the distinguishing characters are not strongly marked.

The original specimen on which the genus was founded is somewhat vertically compressed; giving it an elliptical form. In well-preserved specimens the length is but little greater than the height. The genus is very distinctly limited, and usually easy of recognition among the Devonian forms of this class of fossils.

Examples: *Paracyclas elliptica*, pl. lxxii, figs. 23–33; pl. xcv, fig. 18.
Paracyclas lirata, pl. lxxii, figs. 2–19; pl. xcv, fig. 19.
Paracyclas tenuis, pl. lxxii, figs. 20–22; pl. xcv, fig. 25.

Schizodus, King (Annals and Magazine of Natural History, vol. xiv, p. 313. 1844; Geology of Russia and the Ural Mountains, vol. ii, pp. 308–9. 1845; Monograph of the Permian Fossils of England, pp. 185–8, pl. xv. 1850).

[Type, Schizodus truncatus, King.]

"Diagnosis. Equivalved, inequilateral, the posterior side being the longest. Anterior outline rounded; posterior tapering toward the extremity. Right valve with two smooth cardinal teeth; left valve with three teeth. The teeth of the left valve placed in front of those in the right valve. The central tooth of the former more or less bifid, according to species, on its free side, and embraced by both teeth of the opposite valve. Pallial line entire; smooth or ornamented with fine raised lines, running parallel to the margin."

This genus was proposed, but not described, by Prof. King in the Annals and Magazine of Natural History, as above cited, in 1844, to include certain forms of the Permian and Carboniferous formations which had before been referred to *Axinus*. The diagnosis given by De Verneuil in Geology of Russia, etc., above cited, Mr. King regards as incomplete, and the results of his own observations are given above.

The Devonian species of New York correspond in external characters with the typical species of King, and in three of these we have been able to determine a corresponding hinge structure, and muscular impressions. The external

expression of most of the species of this genus is very characteristic, and there is little difficulty in assigning them to their proper generic association.

At the present time we do not know of any species of the genus below the horizon of the Upper Helderberg group. They are more numerous in the Chemung than in the Hamilton group, and several species have been observed in the Waverly sandstone. The latter have a more extended and narrower posterior end than the Chemung forms.

American examples: *Schizodus tumidus*, pl. xv, figs. 25–29.
Schizodus appressus, pl. lxxv, figs. 3–9; and other species of the same plate of this volume.

Prothyris, Meek (Proc. Acad. Sci. Phila., vol. xxi, p. 172. August, 1869).*
[Type, Prothyris elegans, Meek.]

Shell equivalve, inequilateral, extremely elongate; cardinal and basal margins often sub-parallel; anterior end rounded or sub-truncate, with a deep notch in the antero-ventral margin. Posterior end rounded, lanceolate, or truncate. Cardinal line straight or slightly arcuate. Cardinal slope sometimes sub-alate. Umbonal slope rounded and undefined or sub-angular.

Surface of the shell marked by fine concentric striæ of growth, and in one species described, by fine radiating striæ on the cardinal slope. Internal characters unknown.

Two species of this peculiar generic form have heretofore been described. The type is from the coal measures, and the other from the Waverly sandstone. Four additional species are illustrated in the present volume, two of which are from the Hamilton and two from the Chemung group; one of the latter presenting some peculiarities. The shells of this genus are thin and fragile, pre-

* The only description of this genus which I find is the following, from a footnote on the page above cited: "It is a small, smooth, compressed, elongated, equivalve bivalve, with nearly parallel, straight upper and lower margins, and a distinct, rather large, rectangular notch in the anterior ventral margin, forming a hiatus similar to that seen in the genus *Xylophaga*, though it evidently has no relation to that group, but seems to be allied to the Solenidæ. In Dr. Hayden's Report on the Geology of Nebraska, I have proposed for this genus the name *Prothyris*." The Report on Nebraska, page 223, contains the following: "Prothyris, Meek, 1869, Proc. Acad. Nat. Sci. Phila., July, p. 172."

senting an aspect unlike most other Lamellibranchiata, and in some aspects having much the appearance of a bivalved crustacean.

From our present knowledge of these fossils they appear to form a peculiar group, which may be termed Prothyridæ.

Examples: *Prothyris lanceolata*, pl. lxxvi, figs. 2–8.
Prothyris planulata, pl. lxxvi, fig. 1; pl. xciv, fig. 8.
Prothyris alata, pl. xciv, fig. 7.

Solemya, Lamarck (Hist. v, p. 488; 2d edition, vi, p. 123. 1818).
[Type, S. Australis—a recent shell.]

Shell equivalve, inequilateral, transversely elongate, obtuse at the extremities. Epidermis shining, extending beyond the margin of the shell. Beaks not prominent, scarcely distinct. A cardinal tooth in each valve, dilated, compressed oblique, sub-concave on the upper side to receive the ligament. Ligament in part internal and in part external.

Prof. King (Monograph of the Permian Fossils of England, p. 177) has proposed the generic name *Janeia* for the fossil species before referred to *Solemya*. At a later period, however (in the appendix, pages 246, 247), he has given the result of some further observations upon the recent and fossil species of the genus, and concludes that the latter are true *Solemya*, and gives an emended diagnosis of the genus.

The European fossil species of the genus occur in the Devonian of the Eifel, in the mountain limestone of England, and in the Permian of Russia and of England.

Example: *Solemya vetusta*, pl. xlvii, figs. 53–55; pl. xciv, fig. 10.

Tellinopsis, Hall (Prelim. Notice Lamellibranchiata, 2, p. 80. 1869–70).
[Type, Nuculites subemarginata, Conrad.]

Shell equivalve, sub-equilateral, sub-elliptical. Anterior end rounded. Posterior end sub-truncate or emarginate. Beaks small, not prominent. Cardinal line gently curved. Umbonal slope prominent and defined above.

Surface marked by concentric striæ of growth, and by radiating striæ which may be partially or entirely obsolete. Ligament external, small. Interior characters of hinge and teeth undetermined. Muscular impressions shallow. Pallial line undetermined.

This generic name has been proposed for a fossil species of the Hamilton group, described by Mr. Conrad as *Nuculites subemarginata* (Journal of the Academy of Natural Sciences, Phila., vol. viii, p. 249; pl. xv, fig. 5. 1842). It is very distinct in external characters from any form of *Nuculites* in the absence of the clavicle, which is usually shown near the anterior end, and there is no evidence that the hinge is furnished with teeth of any kind.

The general expression of the fossil suggests its relationship to the Tellinidæ.

Example: *Tellinopsis subemarginata*, plate lxxvi, figs. 21–31.

Cimitaria, Hall (Prelim. Notice Lamellibranchiata, 2, p. 66. 1869–70).
[Type, Cypricardites recurva, Conrad.]

Shell equivalve, extremely inequilateral, transversely elongate; form solenoid, falcate or elongate-trapezoid. Anterior end short and rounded. Posterior end elongate, the extremity truncate. Beaks strongly incurved, umbones prominent. Cardinal line straight or concave. Umbonal slope angular and often strongly defined.

Surface marked by strong concentric lines of growth, which are simple or lamellose, and by fine radiating striæ, which may be more or less strongly marked or altogether obsolete; a more or less distinct depression or cincture extends from the umbones in a slightly posterior direction to the basal margin.

The hinge is marked by a narrow, elongate, ligamental groove, and anterior to the beaks is a strongly defined lunule. Ligament external. Teeth unknown. Muscular impressions and pallial line undetermined.

The species placed under this genus are remarkable for their transversely elongate forms, the greater portion of which is posterior to the beaks. Some of the forms bear a resemblance to *Orthonota*, but the hinge-line shows a distinct ligamental groove and the anterior margin is rounded, with a well-defined

lunule. The species are closely allied to *Pholadella*, and when more forms become known it may prove convenient to unite the two genera. In some important points the genus approaches to *Grammysia* by the way of *Allorisma*. The marked external ligamental area and strong lunule are common to the three genera, while the surface markings have many points in common. In the absence of critical knowledge of the hinge structure we are unprepared to make any more positive assertion regarding this genus and its allied forms.

Examples: *Cimitaria recurva*, pl. lxxvii, figs. 9–14.
Cimitaria elongata, pl. lxxvii, figs. 5–8.
Cimitaria corrugata, pl. lxxvi, figs. 1–4.

Pholadella, Hall (Prelim. Notice Lamellibranchiata, 2, p. 63. 1869–70).
[Type, Pholadella Newberryi.]

Shell equivalve, inequilateral, transversely elongate, ovate, sub-elliptical or trapezoidal. Anterior end rounded or obliquely truncate. Posterior end truncate. Beaks much in advance of the middle of the valve, closely incurved. Umbones prominent. Cardinal line straight. Umbonal slope prominent, rounded or sub-angular. Cardinal slope flat or sub-alate.

Surface marked by fine concentric striæ, and partially by strong concentric undulations, which may be confined to the anterior portion or extend over the body of the shell. Distinct radii, originating at the umbo, mark the central and often the greater portion of the body, leaving the anterior end and cardinal slope free from this ornamentation.

The cardinal margin is marked by a strong cartilage groove, and the anterior end by a deep and sharply defined lunule. The characters of hinge-teeth, and muscular impressions have not been determined.

The typical form of this genus bears many characters of the genus *Cimitaria*, and others are closely allied, by external form, to *Grammysia*. Indeed so close is this external relation that one species of the latter genus, having an elongate form and somewhat peculiar surface markings, has been referred to the genus *Pholadella*. Three well-defined species are illustrated in this volume.

The relations of *Grammysia*, *Allorisma*, *Pholadella* and *Cimitaria*, though apparent in their exterior ornamentation, require further knowledge of the hinge and interior structure before their true affinities can be determined.

Examples: *Pholadella Newberryi*, pl. lxxviii, fig. 25.
Pholadella radiata, pl. lxxviii, figs. 15–21; pl. xcvi, fig. 1.

Phthonia, Hall (Prelim. Notice Lamellibranchiata, 2, p. 70. 1869–70).
[Type, Cypricardites sectifrons, Conrad.]

Shell equivalve, very inequilateral, elongate, sub-elliptical. Anterior end short and rounded on the margin. Posterior end wider, prolonged, sub-truncate above and rounded below. Beaks sub-anterior, small and appressed. Cardinal line straight or slightly arched, ascending from the beak. Umbonal slope rounded, more or less distinctly defined.

Surface marked by fine concentric striæ of growth, and by fine or coarser radiating striæ, which may sometimes become obsolete.

The valves are united by a narrow, elongate, external ligament (shown in fig. 13 of plate lxxviii), but the hinge characters have not been ascertained. The anterior muscular scars are small and not deeply impressed; the posterior scars are superficial. The pallial line is apparently without sinus.

Thus far we know the species of this genus only in the Hamilton and Chemung groups.

Six species have been identified, but the individuals of each one are comparatively rare. Apparently these forms are not closely allied with any other genus among Devonian Lamellibranchs, and for the present constitute a distinct group, which are not difficult of recognition.*

Examples: *Phthonia cylindrica*, pl. lxxviii, figs. 1–4.
Phthonia nodicostata, pl. lxxviii, figs. 5–9.
Phthonia sectifrons, pl. lxxviii, figs. 10–13.

**Phthonia lirata* may be compared with *Solemya*.

Orthonota, Conrad (Geol. Surv. N. Y., Annual Report on the Palæontological Department, p. 50. 1841).

[Type, Orthonota undulata.]

"Equivalved, profoundly elongated. Hinge and basal margins straight and parallel. Beaks near the anterior extremity; posterior extremity truncated."

The above is Mr. Conrad's description. The shells, in all the species referred to the genus, are extremely elongate and inequilateral; the anterior end is rounded and the posterior end truncate. The beaks are near the anterior end. The cardinal line is straight or sometimes slightly concave, extending nearly the entire length of the shell. The umbonal slope is rounded or angular, and defined by one or more distinct folds, which extend to the post-basal extremity.

Surface marked by fine striæ of growth, and in the typical species by strong undulations on the post-cardinal slope and less conspicuously on the anterior end. Two or more defined oblique folds, which may be rounded or angular, extend from the umbones to the posterior and post-basal margins.

Hinge characters unknown; no teeth or crenulations have been observed. Cardinal margin with a long linear fold embracing the ligament, which is apparently internal. The anterior end is without lunule, and the margins of the valves continue in a straight line beyond the beaks. The muscular impressions are obscure, and have not been satisfactorily determined. Pallial line undetermined.

The few species of this genus yet absolutely determined form a very distinct group, and, so far as known, are restricted to the Hamilton and Chemung groups. The first species designated by Mr. Conrad (*Orthonota pholadis*), from the Hudson River group, is known to us only by a figure of the species, and this is evidently not congeneric with *O. undulata*, which Mr. Conrad always regarded as the typical species of the genus.

The characteristics of the genus have not always been fully understood or appreciated by palæontologists, and the inclusion of forms allied to, or identical with, *Grammysia* by several European authors has served to mislead. The species of this genus are always elongate, extremely inequilateral, without

external ligamental cicatrix or lunule, which are always marked features in the Grammysidæ. Some of the species referred to this genus by American authors will ultimately be referred to other genera.

Examples: *Orthonota undulata*, pl. lxxviii, figs. 37–42.
Orthonota carinata, pl. lxxxiii, figs. 34, 35.

Palæosolen, n. sub-genus. [Type, Orthonota siliquoidea, Hall.]

Shell equivalve, very inequilateral, extremely elongate, solenoid. Dorsal and ventral margins sub-parallel. Anterior end short, rounded at the extremity. Posterior end elongate, extremity truncate, gaping. Beaks sub-anterior, small, appressed. Cardinal line straight. Umbonal slope prominent and extending toward the post-basal extremity.

Surface marked by concentric striæ of growth.

Hinge characters and teeth unknown. Ligament apparently internal. Muscular impression and pallial line undetermined.

Surface (of the cast) marked by the remains of fine striæ of growth.

The only species known has the general aspect of *Orthonota*, but the surface is smooth with the exception of the striæ of growth. The posterior end is gaping and the anterior margin has the appearance of being slightly reflexed.

Example and type: *Palæosolen siliquoidea*, pl. lxxviii, fig. 33.

Cypricardinia, Hall (Palæontology of New York, vol. iii, text, p. 266. 1859. Prelim. Notice Lamellibranchiata, 2, p. 81. 1870).
[Type, Cypricardinia lamellosa, Hall.]

Shell inequivalve; the right valve the more convex, very inequilateral; sub-rhomboid, obovate or sometimes trapezoidal, wider posteriorly. Anterior end short, declining from the beaks and rounded below. Posterior end wider and obliquely truncate. Beaks sub-anterior, incurved and appressed. Umbo of the right valve often prominent. Cardinal line straight or arcuate, rising from the beaks. Umbonal slope prominent, often obtusely angular.

Surface marked by strong, concentric, lamellose undulations, with intermediate fine striæ of growth, and in some species by radiating striæ, which are

interrupted at the outer margin of the lamellæ. The valves are crossed obliquely by a shallow byssal sinus.

Hinge-line marked by a long fold or lateral tooth in one valve. Cardinal teeth not determined. Ligament external, strong, leaving in the cast a deep, elongate groove. Anterior muscular impression small, situated just within the anterior margin of the shell. Posterior muscular impression large and strong, situated on the cardinal and umbonal slope a little behind the middle of the length. Pallial line parallel with the margin of the shell.

The largest of our species is not known to reach a length of 30 mm., but Mr. Billings has described *C. distincta* from the Gaspe limestone series, which he says has a greatest length of seventeen lines.

This genus includes a very natural and characteristic group of shells, which begin their existence in the Silurian rocks, and extend to the coal measures; occurring in the Trenton, Niagara, Lower Helderberg, Upper Helderberg, Hamilton, Chemung and Waverly groups. They are usually readily recognized by their form, the inequality of the valves and the lamellose surface. In the *C. planulata*, from the Schoharie grit, the umbonal slope is limited above by a distinct furrow, which is more pronounced on the cast. In addition to the ordinary concentric surface markings, some of the species show radiating striæ originating at the apex of the valve, and these are sometimes crossed by others which are vertical to the direction of the lamellæ. Of the species originally described under this generic term, in the third volume of the Palæontology of New York, only *C. lamellosa* and *C. crassa* can be regarded as strictly belonging to the genus.

This genus is well known in the Palæozoic rocks of Europe.

Examples: *Cypricardites planulata*, pl. lxxix, figs. 1–5.
Cypricardites indenta, pl. lxxix, figs. 6–16, 23.

Palæanatina, Hall (Prelim. Notice Lamellibranchiata, 2, p. 85. 1870).
[Type, Palæanatina typa, Hall.]

Shell inequivalve; left valve larger than the right, inequilateral, transversely elongate, narrowly sub-elliptical or sub-trapezoidal. Anterior end short,

rounded or sub-truncate. Posterior end long, vertically or obliquely truncate, or rounded at the margin. Beaks low, appressed, that of the left valve rising above that of the right. Cardinal line straight or gently arcuate. Umbonal slope prominent and extending to the post-basal extremity. A broad, shallow depression extends from the umbo to the base of the valve, causing a shallow sinus in the ventral margin.

Surface marked by fine concentric striæ of growth.

Ligament partially external; a ligamental groove, just within the dorsal margin, extending nearly to the post-cardinal extremity of the shell. Hinge furnished with two slender processes just beneath the beaks, and in one specimen a slender oblique fold extends backward from beneath the apex; no lateral teeth have been observed. Muscular impressions indistinct; the anterior one small, situated just forward of the beak; the posterior one larger and near the cardinal margin of the valve. Pallial line apparently parallel to and near the ventral margin of the valve.

The shells of this genus are more distinctly characterized by the inequality of the valves than by any other feature. The known species occur in a coarse arenaceous matrix, which renders their condition unfavorable for a critical study of the internal or external characters. These forms seem to have no near allies among the associated fossils of the same or other formations.

Examples: *Palæanatina typa*, pl. lxxix, figs. 26–28, 35–37.
Palæanatina solenoides, pl. lxxix, figs. 38, 39.

Prorhynchus, N. GEN. [Type, Palæanatina quadrata, Hall.]

Shell inequivalve, the left valve the larger and more gibbous; inequilateral, subquadrate or rhomboidal. Anterior end truncate, angular or nasute at the antero-dorsal extremity. Posterior end broad, margin truncate or broadly rounded. Beaks low, appressed, the umbo of the right valve somewhat gibbous and rising above the hinge-line; beak of left valve scarcely above the cardinal line. Cardinal line straight, extending the entire length of the dorsal margin, and alate at both ends. Umbonal slope sub-angular, extending to the post-

basal extremity; post-cardinal slope often with an obscure or more or less defined fold along the middle of its area.

Surface marked by more or less regular, fine concentric striæ of growth.

Hinge-line (in the cast) marked by a groove indicating a strong lateral tooth or fold. There is likewise a groove along the hinge-line anterior to the beak and a divergent furrow extending toward the anterior margin. Ligament external. Muscular impressions and pallial line undetermined.

The species of this genus constitute a remarkable group of inequivalve shells. Their geological position is in the upper part of the Chemung group, and the only others which might be considered as having relations with them are the Palæanatinæ, which are similar in their inequivalve character.

The hinge characters cannot be fully determined, but the remarkable feature of a cardinal line extending the entire length of the shell with a longitudinal fold, which seems scarcely to be interrupted at the beaks, together with the diverging anterior process or clavicle, are characteristic and peculiar features.

Examples: *Prorhynchus quadratum*, pl. lxxix, figs. 40–49; pl. xcvi, fig. 5.
Prorhynchus nasutum, pl. xcvi, fig. 6.
Prorhynchus angulatum, pl. xcvi, fig. 7.

Glossites, N. GEN. [Type, Glossites lingualis, Hall.]

Shell equivalve, inequilateral, narrowly or broadly elliptical in outline. Anterior end short, margin declining from the beak and curving below. Posterior end large, narrowly or broadly rounded at the extremity. Beaks small and appressed, sub-anterior, or in advance of the anterior third. Cardinal line long, gently arcuate. Umbonal slope not defined, prominent above and usually merging into the general convexity of the surface about the middle of the length.

Surface marked by fine concentric striæ of growth, which are often raised into sharp sub-lamellose elevations, or more rarely by stronger concentric ridges. Obscure radiating striæ are rarely observed.

Hinge characters undetermined. There is evidence of an elongate lateral tooth or fold, and the valves are joined by a strong external ligament. Lunule distinct. Muscular impressions shallow.

The species of this genus apparently constitute a very natural group, since they present such characteristic features of form and surface characters.

These shells have sometimes been referred to *Modiomorpha* and to *Sanguinolites*, but they are clearly distinct from either, and cannot be properly referred to any previously established genus.

Some of the species in their natural condition have had considerable convexity, or even gibbosity, in the umbonal region; but they are evidently thin shells, and usually much compressed. The shell rarely preserves evidence of radiating striæ, which are scarcely superficial.

Examples: *Glossites teretis*, pl. xcvi, fig. 15.
Glossites lingualis, pl. xl, figs. 16, 17; pl. xcvi, figs. 9–11.
Glossites ellipticus, pl. xcvi, fig. 8.

Elymella, N. GEN. [Type, Elymella nuculoides, Hall.]

Shell equivalve, inequilateral, ovate-elliptical. Anterior end very short and the margin rounded. Posterior end narrower and rounded at the extremity. Beaks closely incurved; umbo prominent. Cardinal line short. Umbonal slope prominent in the upper part, not defined and merging into the general convexity of the shell.

Surface marked by fine concentric striæ of growth, which are sometimes lamellose and elevated into concentric ridges.

Hinge-line short, the internal characters undetermined. Muscular impressions unknown.

The small group of shells here termed *Elymella* cannot, with propriety, be referred to any established genus, and therefore this name has been chosen in reference to the form and expression of the fossils. The form of the shell and the direction and character of the concentric striæ resemble some species of *Nucula;* but although occurring with specimens of the latter genus showing the hinge teeth, none of the specimens of *Elymella* have preserved any indication of such characters.

Examples: *Elymella fabalis*, pl. xl, figs. 5, 9.
Elymella nuculoides, pl. xl, figs. 6, 7, 8.

Sanguinolites, McCoy (Carboniferous Fossils of Ireland, p. 47. 1844).

The following is Prof. McCoy's original description:

"Transversely oblong, convex, equivalve, very inequilateral. Basal and ventral margins parallel or nearly so. Anterior end short, rounded. Posterior side lengthened, obliquely truncate, gaping. An oblique ridge usually extends from the beak to the anal angle, but no flexure; ligament external."

"This genus has been formed to include a number of fossil shells of the older rocks, hitherto classed with Sanguinolaria. The latter shells have the ventral and dorsal margins curving toward each other posteriorly, forming a sub-mucronate beak-like termination to the posterior end, while on the contrary, the dorsal and ventral margins of the present shells are nearly parallel, so that the posterior end is as wide or wider than the other parts of the shell; they are also much more gibbous and have no posterior fold."

By reference to the figures cited, or given in illustration of the forms of this genus, it will be seen that they are not congeneric, and later authors in adopting the name, and endeavoring to reconcile the difficulties, have not made the matter more clear. On carefully reviewing the subject, and giving due weight to the later expressions of Prof. McCoy,* and to the illustrations which he claims to be characteristic species of the genus, I find the reasoning which I adopted fifteen years ago† to be untenable, and therefore the group of species then referred to *Sanguinolites* have received another generic designation.

One of the characteristic forms of the genus referred to by Prof. McCoy, *S. sulcatus*, has been made the type of the genus *Allorisma* by Prof. King; but there still remains a group of shells with strong concentric ridges or undulations of the surface, which are without posterior fold, or defined umbonal ridge, and cannot be properly referred to *Grammysia* or *Allorisma*, but which correspond with some of the forms referred to this genus by its author.

* British Palæozaic Fossils, page 276. 1854.

† Preliminary Notice of the Lamellibranchiata, 2, page 34.

Protomya, N. GEN. (Palæomya by error, in Explanation of Plate lxiii; not Palæomya, Zittel and Goulers). [Type, Protomya oblonga, Hall.]

Shell equivalve, inequilateral, elongate, ovate-elliptical. Anterior end broadly rounded. Posterior end narrower and regularly rounded at the extremity. Beaks incurved. Umbo prominent. Cardinal line long, nearly straight. Umbonal slope gibbous above, merging into the general convexity below.

Surface marked by fine striæ of growth and strong concentric undulations.

Hinge characters unknown. Ligament external. Muscular impressions circular, the anterior one strong and situated near the anterior margin.

This form cannot with propriety be referred to any of the established genera of palæozoic fossils. It differs from *Grammysia* very distinctly in the absence of a mesial cincture, umbonal ridge, and deep ligamental cicatrix; and less strongly from *Allorisma* in the same characters. The beak is more nearly central than in either of these genera and the surface presents no evidences of radiating striæ.

Promacrus, Meek (Am. Jour. Conchology, vol. vii, p. 4. 1871). [Type, Promacrus Andrewsi, Meek.]

Shell equivalve, sub-equilateral, elongate, sub-trapezoidal; anterior end much produced and narrowly rounded at the extremity; posterior end more or less produced, obliquely truncate. Beaks sometimes sub-central, appressed, rising little above the cardinal line. Cardinal margin nearly straight behind the beaks, and declining in front. Umbonal slope distinctly angular, extending to the post-basal extremity and leaving a broad cardinal slope above.

Surface marked by fine striæ of growth which are often fascicled and raised into more or less distinct undulations. The anterior portion of the shell is marked by strong radiating interrupted striæ or ridges, which give the surface a cancellated appearance.

Hinge characters undetermined. There are evidences of teeth beneath the beaks, but no lateral teeth have been observed. The ligament is external. Muscular impressions unknown.

Examples: *Promacrus Missouriensis*, Swallow, sp.

Promacrus cuneatus, Hall, pl. lxxviii, fig. 28.

Cytherodon, Hall (Twenty-third Report on the State Museum of Natural History. Generic illustrations, pl. xiv, fig. 21. 1872).

[Type, Cytherodon nasutus, Hall.]

Shell equivalve, inequilateral, form rhomboid-ovate, gibbous; anterior end short, declining almost vertically from the beaks and rounded below into the basal margin. Cardinal line arcuate. Umbonal slope gibbous, not defined. Post-cardinal slope concave.

Surface marked by fine concentric striæ of growth which become lamellose below and posteriorly.

Hinge area strong, with several angular teeth or crenulations beneath and anterior to the beaks. Posterior to the beaks the hinge-line is marked by a deep ligamental groove. Anterior muscular scars distinct, just within the margin of the shell; posterior one large and shallow, situated on the post-cardinal slope. Pallial line simple.

The general form of this shell is similar to some species of *Schizodus*, but the umbonal slope is less defined, the muscular impressions are not so strong, and are differently situated. The hinge characters are entirely distinctive. Before having learned the hinge structure of the American forms of the latter genus I referred some of them to *Cytherodon* in the belief that they were generically identical. A further study of these forms has shown the hinge teeth and muscular impressions corresponding to *Schizodus*. These differences may be seen by comparing figs. 1, 2 and 3 with figs. 11 and 12 of plate lxxv and with fig. 30 of plate xcv.

The typical form is known in the Hamilton group of Maryland and New York.

Type and example: *Cytherodon nasutus*, pl. lxxv, figs. 11, 12; pl. xcv, fig. 30.

Clinopistha, Meek and Worthen (Proc. Acad. Nat. Sci., Phila., p. 43. 1870).
Dystactella, Hall and Whitfield (Twenty-fourth Ann. Rep. N. Y. State Museum Nat. Hist., p. 192. 1872).
Compare *Solemya*, Lamarck. 1818.
[Type, Clinopistha antiqua, Meek.]

Shell equivalve, inequilateral, transversely sub-elliptical, obliquely truncate in front, with a callosity or fold occupying the place of the lunule. Beaks small, situated anterior to the middle. Anterior end oblique, often nasute below. There is usually a broad shallow cincture extending from the beaks to the base, sometimes constricting the margin.

Test thin. Surface, in the known species, marked by concentric striæ of growth. Internal characters not satisfactorily determined. Several specimens have shown some indications of crenulations along the hinge, but this appearance may be due to the crystallization, and subsequent partial solution, of the margin of the shell. Ligament external. Muscular impressions of moderate size, distinctly marked, situated near the margins of the valve. Pallial line entire, composed of a series of radiating pustules as seen on the cast.

The species formerly referred to *Dystactella* appear, on further examination, to be congeneric with *Clinopistha*, and it would seem that this latter genus does not differ exteriorly from *Solemya*, except in the oblique anterior end and absence of radii.

The type species has many points of resemblance to the species which was made the type of *Dystactella* (*D. subnasuta*), and further collections may prove their identity.

Example: *Clinopistha subnasuta*, pl. li, figs. 32, 33; pl. xcv, fig. 31.

Modiella, Hall (Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. lxxvii, figs. 9–20. 1883).
[Type, Modiella pygmæa, Conrad, sp.]

Shell equivalve, very inequilateral, obovate. Anterior end short. Posterior end very broad and curved, or obliquely sub-truncate at the extremity. Beaks anterior. Cardinal line arcuate. Umbonal region prominent above, merging into the general convexity below.

Surface marked by fine concentric striæ with some faint curving radiating striæ on the body of the shell.

Hinge marked by an elongate groove and fold. Ligament linear. Anterior muscular impression just beneath the beak and occupying the upper part of the distinct anterior lobe, which is separated from the body of the shell by a byssal sinus. Posterior muscular impression large and shallow. Pallial line simple, parallel to the margin of the shell.

The shell is, in all respects, very similar to some recent forms of Modiola.

Type and example: *Modiella pygmæa*, pl. lxxv, figs. 9–20.

Megambonia, Hall (Palæontology of New York, vol. iii, p. 273, and Twelfth Report of the State Cabinet of Natural History, p. 12. 1859).

[Type, Megambonia cardiiformis, Hall.]

Shell equivalve or sub-equivalve, very inequilateral, obovoid, body very oblique; anterior end (in two typical forms) lobed; posterior large, constituting the principal part of the shell; beaks anterior; cardinal line short, sub-alate posteriorly; umbonal slope ventricose, not defined.

Surface marked by fine striæ of growth, which in some species are crossed by fine radiating striæ. Hinge-line short; a distinct lateral fold and groove near the post-cardinal angle. Ligament internal. Anterior muscular impression large and strong; posterior impression large.

The type of this genus is well marked, and its form and external characters are very distinctive. It does not, however, show the anterior teeth or crenulations mentioned in the original description.

In the third volume of the Palæontology of New York, several species are described under this designation, which farther study has shown not to be congeneric. At the present time the only forms which I regard as strictly belonging to the genus are from the Corniferous limestone and Oriskany sandstone. Those from the Lower Helderberg group require more material for a final determination.

Examples: *Megambonia cardiiformis*, pl. iii, figs. 1–8.

Megambonia bellistriata, pl. cix, fig. 4; Pal. N. Y., vol. iii.

Megambonia? lamellosa, pl. cix, figs. 5, 6; Pal. N. Y., vol. iii.

Amnigenia, Hall. (Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. xl, figs. 1–4; pl. lxxx, fig. 12).

[Type, Amnigenia Catskillensis, Vanuxem, sp.]

Shell equivalve, very inequilateral, elongate, sub-elliptical or narrowly sub-obovate. Anterior end very short, the margin rounded. Posterior end prolonged and wider than the anterior, the extremity rounded. Beaks sub-anterior, low and appressed. Cardinal line gently arcuate. Umbonal slope convex, not defined.

Surface marked with concentric striæ of growth, which become lamellose on the posterior portion of the shell. An obscure, broad depression extends from anterior to the beaks, obliquely to the ventral margin.

Hinge-line long, marked by one or two lateral folds parallel to the dorsal margin. Other characters of the hinge unknown. Ligament strong, external, extending more than half the distance from the beak to the posterior end of the shell. Anterior muscular impression large and prominent, situated just anterior to the beaks. Posterior muscular impression large, shallow. Pallial line simple.

The specimens of the type species vary very much in form and proportions from the conditions under which they have been imbedded in the matrix. The specimens illustrated on plate xl, figs. 2, 3 and 4, and plate lxxx, fig. 12, although laterally compressed, appear to retain nearly their natural form and proportions. The specimen fig. 1, of plate xl, represents a very common condition of the fossil when the shell has been vertically compressed and the proportions are distorted.

This genus does not possess characters which properly ally it with any of the palæozoic marine families. From its occurrence with the remains of land plants, and the absence of brachiopoda, and other marine life, in the rocks where it is found, it would seem that the single species yet observed had its habitat in fresh or brackish water, and is a primitive representative of the comparatively recent genus *Margaron*.

Type and example: *Amnigenia Catskillensis*, pl. xl, figs. 1–4; pl. lxxx, fig. 12.

APPENDIX.

Observations upon the genus PERNOPECTEN, and allied genera.*

PERNOPECTEN, WINCHELL.

Proc. Acad. Nat. Sci. Philadelphia, p. 125. 1865.
[Type *Aviculopecten limiformis*, White and Whitfield.]
In part *Entolium*, MEEK. Geol. Surv. California, vol. i, p. 479. 1865.

"Generic Characters.—Shell bivalve, sub-equivalve, monomyary. Valves more or less inequilateral and auriculate. Hinge-line straight; hinge furnished with a central, triangular cartilage-pit, and a transverse plate bearing on each side of the middle, a series of smaller pits, diminishing in size and depth from the centre outward. The shell seems to be thin, and probably has a structure more like *Pecten* than *Perna*."

Fig. 1. PERNOPECTEN LIMIFORMIS. A view of the type specimen of the species and of the genus Burlington sandstone. *Burlington, Iowa.*

Fig. 2. An enlargement to two diameters of the cardinal portion of the preceding as obtained from a gutta-percha impression, showing more clearly the characters of the hinge.

Fig. 3. PERNOPECTEN SHUMARDANUS. An enlargement of the cardinal portion of one of the type specimens of this species, showing the characters of the hinge. Waverly group. *Newark, Ohio.*

*These observations were written in 1884 to accompany a general description and discussion of the Palæozoic Monomyaria, and formed a part of the original plan for the introduction to the present volume. The discussions of the genera of the Monomyaria have been deferred for the present, but as the genus Pernopecten has been recognized in the Report of the State Geologist for 1882, and also referred to in note, p. 81, Pal. N. Y., vol. v., pt. 1, Lamellibranchiata, 1, it is necessary to introduce here the portion treating of Pernopecten and allied forms.

Considerable confusion has arisen as to the validity and characters of the genera *Pernopecten* and *Entolium*, and a short historical sketch, and critical discussion of these genera is here given.

1865. In the Report of the Geological Survey of California, vol. 1, Appendix B, p. 478, Mr. Meek proposed the name *Entolium* as a subgenus of *Amussium* of Klein, for a species (*E. aurarium*) found in the auriferous slates of California, and supposed to be of Jurassic age (pp. 477–479 *ut cit.*). The figure illustrating this species is of a pectenoid shell, the external surface of which presents the concentric striæ without radii; the internal characters not shown nor described.

At the end of the description of *Amussium aurarium* Mr. Meek says: "This species appears to belong to a group of thin lenticular, sub-equivalve, smooth or concentrically marked shells, with short, equal, flat, obtusely angular ears, which are not defined in either valve, or on either side, by a distinct marginal byssal sinus. They differ from the typical species of *Amussium*, in having the lateral margins closed, and the valves without internal radiating costæ. This group may be distinguished by the name *Entolium*, with *Pecten demissus*, of Phillips (as figured by Quenstedt, in his Der Jura, i, tab. 48, f. 6 and 7), as its type."

1872. In the Final Report of the U. S. Geological Survey of Nebraska, p. 189, Mr. Meek cites the genus *Entolium* and publishes under it *E. aviculatum*, Swallow sp.=*Pecten aviculatus*, Swallow (Trans. St. Louis Acad. Sci., vol. 1, p. 215. 1858). After describing the shell, Mr. Meek says: "This shell evidently belongs to a group for which I proposed, in the California Report, the name Entolium with *Pecten demissus*, Phillips (not Fleming), as illustrated in Quenstedt's Der Jura, pl. 48, fig. 6, as the type." Mr. Meek illustrates *E. aviculatum*, pl. 9, fig. 11, and also copies from Quenstedt the hinge structure of *E. demissum*, in illustration of the generic characters (*ut cit.*, pl. 9, fig. 14).

1873. In the Report of the Geological Survey of Illinois, vol. V, p. 588, we find the following: Genus Entolium, Meek. *Entolium aviculatum*, Swallow sp., pl. 26, figs. 12*a*, *c*.

Pecten aviculatus, Swallow, 1858. Trans. St. Louis Acad. Sci., vol. 1, p. 213.

Entolium aviculatum, Meek. Final Report on Neb., p. 189, pl. 9, figs. 11*a*, *f*.

1875. Geological Survey of Ohio, vol. 2, pl. 11; Palæontology, 292, Mr. Meek describes *Entolium Shumardianum*, Winchell? (sp.), pl. 15, figs. 4*a*, *b*= *Pernopecten Shumardianus*, Winchell (1865). Proc. Acad. Nat. Sci. Philad., xvii, 126.

Compare *P. limatus*, Winchell (1865), *ib.*, and *Avicula Cooperensis* (1855), Missouri Geol. Rep.

1877. Mr. S. A. Miller, Catalogue of American Palæozoic Fossils, cites *Entolium avicula*, Swallow, 1858 (*Pecten aviculus*), Trans. St. Louis Acad. Sci., Coal Measures, and *E. Cooperensis*, Shumard, 1855 (*Avicula Cooperensis*), Low. Carb.

1865. Professor A. Winchell describes the genus Pernopecten (Proc. Acad. Nat. Sci. Phila., 1865,* p. 125.

The author founds the genus upon *Aviculopecten limiformis*, White and Whitfield, from the Burlington sandstone of Iowa. Professor Winchell also includes under this genus, *Pernopecten limatus*, and a new species from the base of the Burlington limestone, together with *Pernopecten Shumardianus*, Winchell, which he says is *Avicula circulus*, Hall (not of Shumard) with *Lima? obsoleta*, Hall, *Lima glaber*, H., and mentions several European species. "It agrees with "*Amussium* in its sub-symmetrical ears, central cartilage-pit, and the absence of "radiating ridges, but differs in its straight hinge-line and lateral cartilage-pits.

"It is probable that in addition to the two following species, others referred "to *Avicula*, *Peterinea* and more especially *Aviculopecten*, *Amussium* and *Pecten*, "will be found to possess the assemblage of characters shown in *Pernopecten*. "*Lima? obsoleta*, Hall (Rep. 4th [10th in error] Dist. N. Y., p. 265)=Pecten "sub-obsoletus, D'Orb., is stated to have a 'crenulated hinge-line,' while its "external characters are quite conformable to *Pernopecten*. Not improbably "*Lima glaber*, Hall, belongs to the same association. The same may be said of "*Pecten densistria*, Sandb., from the *Posidonomyenschiefer* of Nassau; *Avicula* "*tumida* and *Avicula lævigata*, de Koninck, from the Carboniferous limestone of "Belgium, etc., etc." [Proceedings Acad. Nat. Sci., Phila., July, 1865, pp. 125, 126.]

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*This publication bears the imprint of July, 1865. The Geological Report of California, containing the original description of Entolium, bears date of 1865, and the Preface is dated November, 1865.

1866. Geological Survey of Illinois, Palæontology, vol. II, p. 334. Under the discussion of *Streblopteria*, Mr. Meek states that "Prof. Winchell has proposed the name *Pernopecten** (Proc. Acad. Nat. Sci., Phila., July, 1865, p. 125), for a somewhat similar type. That genus, however, differs in having a central cartilage-pit under the beaks, with smaller pits along the hinge on each side, while it wants the deep byssal sinus under the anterior ear of the right valve, seen in Streblopteria."

1868. Geological Survey of Illinois, vol. III, p. 453. Mr. Meek cites *Pernopecten*, Winchell (1865), with the species *P. Shumardanus*, Winchell? pl. 14, figs. 6*a*, *b*, and the following synonymy:

"*Avicula circulus*, Hall, 1858, Geological Report Iowa, vol. 1, part ii, p. 522, pl. vii, fig. 9. "Not *A. circulus*, Shumard, 1855, Missouri Report, pl. C, fig. 14.

"*Pernopecten Shumardianus*, Winchell, 1865, Proc. Acad. Nat. Sci., Phila., p. 126.

"Compare *A. Cooperensis*, Shumard (1855), Missouri Report, pl. C, fig.
" 15 = ? *Aviculopecten limaformis*, White and Whitfield (1862), Proc. Bos-
" ton Soc. Nat. Hist., vol. viii, p. 295.

1875. Geological Survey of Ohio, vol. 2, part ii, Palæontology; Mr. Meek places *Pernopecten Shumardanus*, Winchell, under the genus *Entolium*. See citations under the latter genus.

1877. Mr. S. A. Miller cites in his Catalogue the following species, viz.: *Pernopecten crenulatus*, H., *P. fasciculatus*, H., *P. glaber*, H., *P. limiformis*, White and Whitfield, *P. limatus*, Winchell, *P. obsoletus*, H., *P. Shumardanus*, Winchell.

From an investigation of the literature upon *Pernopecten* and *Entolium*, and a study of the type specimens of the former genus, it is evident that *Pernopecten* has priority and includes *Pecten demissus* of Phillips. *Entolium*, if existing in nature, should be restricted to the species first indicated (*E. aurarium*), and other allied forms, if any, and it is probably not found at all in the palæozoic

* "The type of *Pernopecten* is *P. Cooperensis* — (*Avicula Cooperensis*, Shumard,— *Aviculopecten limaformis*, White and Whitfield). The typical specimen of this species, figured by Dr. Shumard in the Missouri Report, shows a few obscure radiating costæ—an exceedingly rare character, though we have occasionally seen faint indications of them on other specimens. Hence, Dr. Shumard's species has not been generally identified, and Prof. Hall, in the Iowa Report, p. 522, pl. 7, fig. 9, erroneously refers apparently the same shell to *Avicula circulus*, of Shumard, a quite different species." [Meek.]

formations. The typical species of *Pernopecten* of Winchell, erroneously included by Meek under *Entolium*, have a crenulated hinge-plate, although from the nature of the matrix this feature is often obscure or concealed, and the crenulations are easily abraded by friction.

Pernopecten should, in addition to the typical species, include those which were afterward referred to *Entolium*, and properly exclude some of the New York species of the Chemung group.

Euchondria is not well understood, although different from *Auiculopecten* as usually characterized. At present it can only comprise the species described as *Aviculopecten neglectus*, Geinitz.

CRENIPECTEN, Hall.

Pal. N. Y., vol. v, pt. 1. Plates and Explanations: p. 3. 1883.
[Type C. crenulatus, Hall.]

Shell pectenoid in general form; anterior ear the larger. Surface smooth or radiated. Hinge furnished with a series of small, sub-equal, ligamental pits or vertical teeth throughout its entire length.

See plate ix, figs. 15 and 17 of *C. crenulatus*, and fig. 28 of *C. Winchelli*.

This genus was instituted to include a number of species in the Chemung and Waverly groups, which have a continuous row of sub-equal cartilage-pits along the margin of the hinge. In *Pernopecten* there is a ridge on each side of the cartilage-pit, sloping downwards and following the course of the lower side of the ears. Also the row of ligamental pits is not in a straight line, but elevated towards the extremities of the ears, and it is interrupted by the well-marked central cartilage-pit.

The external form of several of the species referred to *Crenipecten* bears considerable resemblance to some species of *Streblopteria*, but that genus has a slender, oblique, posterior cardinal tooth, and the ligament is contained in a simple narrow groove along the margin of the ears.

EUCHONDRIA, Meek.

Am. Jour. Sci., 3d ser., vol. vii, p. 445. 1874.
[Type *Pecten neglectus*, Geinitz.]

"Mr. Meek states, in a letter to one of the editors, that he proposes to institute the genus *Euchondria* for *Pecten neglectus* of Geinitz, on account of its peculiar hinge as illustrated by figure 7*c*, plate xxvi, in vol. v, of the Illinois Geological Report."

This genus as illustrated by Mr. Meek (*ut cit.*) has an unsymmetrical subrostral cartilage-pit, and the crenulations on the two sides are unequal.

If these characters can be shown in other specimens and other species, it is probable that this genus will prove to be clearly distinct. At present it can include only a single species, *E. neglecta*.

The figures of this species given in the Palæontology of Illinois, are introduced for comparison with *Pernopecten* and *Crenipecten*.

Figs. 4, 5. Euchondria neglecta (Geinitz, sp.). A reproduction of figs. 7*c* and 7*a*, of plate xxvi, Geol. Surv. Illinois, vol. v. Fig. 4, a right valve, enlarged to two diameters. Fig. 5, an enlargement of the hinge. Coal measures. *Illinois*.

LAMELLIBRANCHIATA.

LAMELLIBRANCHIATA

OF THE

UPPER HELDERBERG, HAMILTON, PORTAGE AND CHEMUNG GROUPS.

II.

DESCRIPTIONS OF SPECIES.

MODIOMORPHA, Hall. 1870.

Modiomorpha Schoharie.

PLATE XXXIV, FIG. 13; AND PLATE XXXV, FIG. 14.

Modiomorpha Schoharie, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 34, fig. 13. 1883.

Shell large, general form ovate, narrow in front; length one-third greater than the height; ventral margin broadly curved; posterior margin abruptly rounded. Anterior end obliquely truncate above, abruptly rounded below.

Hinge-line oblique, equal to two-thirds the height of the shell.

Beaks oblique, situated on the anterior fourth of the shell, depressed, rising very slightly above the hinge. Umbonal region depressed convex.

Test marked by strong, irregular, lamellose striæ of growth, which are stronger on the anterior end and pallial margins.

The muscular impressions are well-defined in the cast of the interior. The anterior adductor is the smaller and situated in the lower portion of the anterior end of the valve. The posterior adductor is sub-circular and located in the lower portion of the post-umbonal slope. Pallial line deeply impressed, following near to the ventral margin of the valve.

A small specimen preserving both valves has a length of 53 mm., height 38 mm., and depth of both valves 13 mm. A large right valve has a length of 80 mm., and a height of 36 mm.

This species is distinguished by the comparatively great width of the valves, the rounded ventral margins and the compressed form of the shell. It resembles *M. Clarens* in general form, but the posterior end is not so regularly rounded, and the valves are higher than in that species. In *M. complanata* the umbo is more prominent, the anterior end narrower and rounded, the posterior end not so regularly rounded, and the posterior muscular impression is farther within the cavity of the valve.

Formation and locality. In the Schoharie grit, Schoharie, N. Y.

Modiomorpha regularis, n. sp.

PLATE XXXV, FIG. 12.

Shell above the medium size, elongate, sub-elliptical; length less than twice the height; anterior margin abruptly rounded; ventral margin broadly curved; posterior margin regularly rounded. Anterior end somewhat narrow.

Valves depressed convex; the point of greatest convexity being near the middle of the length.

Hinge-line longer than the height of the valve, very slightly oblique.

Beaks depressed. Umbonal region moderately convex.

Test marked by strong concentric laminæ of growth. Interior unknown.

A right valve has a length of nearly 70 mm., and a height of 40 mm.

This species differs from *M. Schoharie* in its more elongate form, longer hinge-line and more rounded anterior end. It somewhat resembles certain forms of *M. mytiloides*, but the hinge is not so oblique as in that species, the anterior end is broader, and the ventral margin is more regularly curving.

Formation and locality. In the Schoharie grit, Schoharie, N. Y.

Modiomorpha putillus.

PLATE XLI, FIGS. 1, 2.

Modiomorpha putillus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 1, 2. 1883.

Shell small, sub-ovate, gibbous; height more than half the length; anterior margin abruptly rounded; base broadly curving. Anterior end convex, limited by a broad depression extending backward from a point just anterior to the beak to the ventral margin.

Valves very convex and obtusely sub-angular along the post-umbonal slope; the point of greatest convexity is a little anterior to the middle of the length of the shell.

Hinge-line slightly oblique, somewhat longer than the height of the shell.

Beaks prominent, curving down to the hinge-line. Umbonal region gibbous.

Test not preserved. The internal mould shows traces of strong concentric laminæ which probably marked the exterior shell.

Anterior muscular impression comparatively large, situated close to the anterior margin. Pallial line strongly impressed. Other characters of the interior unknown.

A specimen of normal form and preserving both valves has a length of 17 mm., height 10.5 mm., and depth of both valves 9 mm.

This species more nearly resembles *M. neglecta* of the Chemung group than any other, but may be distinguished by its narrower form and less oblique hinge-line.

Formation and locality. In the Schoharie grit, Schoharie, N. Y.

Modiomorpha (?) ponderosa.

PLATE XXXIV, FIGS. 11, 12; and PLATE XXXV, FIG. 8.

Sanguinolites? ponderosus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 35. 1870.
Modiomorpha ponderosa, Hall. S. A. Miller, Cat. Amer. Pal. Foss., p. 196. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 34, figs. 11, 12. 1883.

Shell large, rhomboid-ovate, gibbous; length one-third greater than the height; posterior margin broadly rounded; basal margin slightly concave toward

the anterior. Anterior end comparatively narrow and abruptly rounded, limited by a broad depression extending from the beak to the basal margin about one-third the length of the shell from the anterior extremity.

Valves very convex, gibbous in the middle and in the umbonal region; the greatest convexity is about the middle of the length, sloping toward the posterior end more abruptly than toward the umbo. The depth of both valves is nearly equal to the height of the shell.

Hinge-line oblique, equal to two-thirds the length of the shell.

Beaks prominent, incurved, directed forward. Umbonal region gibbous, rising considerably above the cardinal-line; posterior slope sub-angular.

Test thick, concentrically striated; its special characters unknown.

Muscular impressions large; posterior impression situated on the cardinal slope.

The specimen described has a length of 105 mm., height 70 mm., and the depth of both valves is about 60 mm.

This species is distinguished by its rhomboid-ovate form, its great gibbosity, and the prominence of the umbonal slope. The relations of this form with MODIOMORPHA are not satisfactorily determined.

Formation and locality. In the upper member of the Upper Helderberg limestone, at Clarence Hollow, Erie county, N. Y.

MODIOMORPHA COMPLANATA.

PLATE XXXIV, FIG. 14; AND PLATE XLI, FIG. 3.

Modiomorpha complanata, HALL. Prelim. Notice Lamellibranchiata, 2, p. 73. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 34, fig. 14; pl. 38, figs. 1-16. 1883.
" *perovata*, HALL. In error. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, fig. 3, 1883.

SHELL large, broadly sub-ovate; length one-third greater than the height; basal margin very broadly rounded; posterior margin abruptly and regularly rounded; cardinal margin arcuate. Anterior end narrow, sub-truncate just below the beak and abruptly rounded below.

Valves moderately convex; greatest convexity anterior to the middle.

Hinge-line oblique; length less than the height of the shell, merging into the general curvature of the cardinal border.

Beaks sub-anterior, appressed. Umbonal region moderately convex, not gibbous.

Test thick, marked by concentric laminæ of growth.

Anterior muscular impression close to the lower anterior margin. Pallial line essentially parallel to the basal margin. Posterior muscular impression large, situated upon the post-cardinal slope at some distance from the margin of the valve. The internal mould shows strong radiating grooves from the pallial line toward the basal margin.

A large specimen has a length of 115 mm., and a height of 81 mm. A somewhat smaller specimen has a length of 103 mm., a height of 71 mm., and the depth of both valves, in the cast, is 24 mm.

This species somewhat resembles *M. macilenta*, but is slightly more elongate, much more regularly rounded posteriorly, the cardinal line more regularly and broadly arched, the anterior extremity less produced, the beak more obtuse, and the umbonal slope less defined.

The specimen fig. 3, plate xli, was erroneously referred to *M. perovata*, in Pal. N. Y., vol. v, pt. 1, Plates and Explanations, but clearly belongs to the present species.

Formation and localities. In the Corniferous limestone, six miles N.-W. of Delaware, O.; and Babcock's Hill, Herkimer county, N. Y.

Modiomorpha Clarens, n. sp.

PLATE XLI, FIG. 4.

Modiomorpha perovata (M. & W.), sp., Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, fig. 4.
Not *Modiolopsis perovata*, Meek & Worthen. Proc. Acad. Nat. Sci., p. 246. 1865.
" ? " " " Pal. Illinois, vol. iii, p. 438; pl. 11, fig. 2. 1868.

Shell of medium size, ovate, sub-elliptical; length nearly one-third greater than the height; basal margin broadly curving (too straight in the figure); posterior margin regularly rounded; cardinal margin arcuate. Anterior end

abruptly rounded below and sub-truncate above, produced considerably beyond the beaks.

Valves moderately convex; the point of greatest convexity is a little anterior to the middle.

Hinge-line oblique; length less than one-half the length of the shell.

Beaks small, appressed. Umbonal region moderately convex, gently merging into the general surface of the shell.

Test strong, marked by regular laminæ of growth and fine concentric striæ. Interior unknown.

The specimen described has a length of 65 mm., and a height of 42 mm.

The shell is proportionally longer than in *M. Schoharie* and not so broad posteriorly. It is not so extended anteriorly as in *M. macilenta* and *M. mytiloides*, and not so prominent in the umbonal region. Compared with *M. alta*, the hinge is shorter, less oblique, posterior margin much more regularly rounded, basal margin more convex, and the umbonal slope less distinctly defined. A larger collection of specimens for comparison may show that this species has a near relation to *M. complanata*.

This species has been identified with *M. perovata*, but a comparison shows it to differ in the broader arcuation of the basal margin and the greater extension of the anterior end.

Formation and locality. In the upper member of the Upper Helderberg group, Clarence Hollow, Erie county, N. Y.

Modiomorpha linguiformis.

PLATE XXXIV, FIGS. (15?) 16, 17.

Modiomorpha linguiformis, Hall. Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 34, figs. 15–17. 1883.

Shell of medium size or larger; form sub-elliptical; length less than twice the height; basal margin gently curving; posterior margin abruptly rounded; cardinal margin arcuate, greatest elevation near the middle of its length. Anterior end abruptly rounded, extending but little beyond the beaks.

Valves convex, not gibbous; greatest convexity about the middle of the shell.

Hinge-line oblique, extending for more than half the length of the shell.

Beaks sub-anterior, not prominent, directed forward. Umbonal region convex, sometimes approaching to gibbous, not strongly defined.

Test thick, marked by concentric striæ.

Anterior muscular impression strong. Pallial line, in the cast, marked by a ridge extending parallel to the basal margin.

A medium-sized specimen has a length of 60 mm., and a height of 35 mm.

This form is proportionally longer than *M. Schoharie*, and broader than *M. cymbula*, which is also sub-nasute on the posterior end, with more depressed beaks.

Formation and localities. In the limestone of the Upper Helderberg group, near Columbus, O., and Cayuga, Ont.

Modiomorpha concentrica.

PLATE XXXIV, FIGS. 9, 10; PLATE XXXV, FIGS. 1-5; AND PLATE XXXVI, FIGS. 1-16 (17, 18?).

Pterinea concentrica, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 116. 1838.
Cypricardites concentrica, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 52. 1841.
" *oblonga*, " Geol. Surv. N. Y., Ann. Rep., p. 52. 1841.
Modiola concentrica, " Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 196, tab. 78, fig. 9. 1843.
Modiomorpha concentrica, " " Prelim. Notice Lamellibranchiata, 2, p. 73. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 34, figs. 9, 10; pl. 36, figs. 1–16 (17, 18?). 1883.

Shell of medium size, ovate, extremely variable in its proportions; length less than twice the height; basal margin often nearly straight, usually a little concave on the anterior third; posterior margin abruptly rounded below and more gently curving above; cardinal margin oblique in the prevailing forms, moderately arcuate, often nearly straight, sub-alate in many specimens. Anterior end produced beyond the beaks, abruptly rounded, sometimes nasute, limited by a broad depression extending from the beak to about the anterior third of the basal margin.

Valves moderately convex, gibbous along the umbonal slope; the point of greatest convexity is about the anterior third of the length of the shell.

Hinge-line extending half, or sometimes more than half, the length of the shell.

Beaks sub-anterior, small, sharply angular, appressed, directed forward. Umbonal region a prominent sub-angular elevation, extending obliquely from the beak toward the post-basal margin, usually dying out about the middle of the length of the shell.

Test comparatively thick, strongly ornamented by regular concentric, rounded or sub-angular striæ, which become lamellose and coalescing on the anterior end of the valves, where they are less prominent.

Anterior muscular impression strong, striated, situated just within the anterior margin, with a small retractor scar above it. Posterior impression large and shallow. Pallial line moderately impressed. Hinge furnished with a strong cardinal tooth just posterior to the beak in the left valve, and a corresponding depression in the right valve. No proper lateral teeth have been observed, but the cardinal margin is thickened and grooved from the beak backward about half the length of the cardinal line.

Several specimens showing the ordinary range of form have the respective lengths of 50, 40, 40, 30, 52, 63, 68 mm., and heights of 27, 25, 30, 22, 32, 38, 38 mm.

This species resembles *M. mytiloides*, but may be distinguished by its usually smaller size in full-grown specimens, more prominent umbonal region, more arcuate form, less prominent anterior end, and by the strong, regular, concentric striæ. It is a more elongate form than *M. alta*.

Formation and localities. In the shales of the Hamilton group from the eastern portion of the State; abundant in the central portion of the State, and less abundant in the softer calcareous shales in the western part of the State of New York; in the siliceous layers above the hydraulic limestone at the Falls of the Ohio, at Charleston, Ind., and in the shales of this group, near Cumberland, Md.

MODIOMORPHA MYTILOIDES.

PLATE XXXVII, FIG. 3; AND PLATE XXXVIII, FIGS. 1–16.

Cypricardites mytiloides, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 52. 1841.
Modiomorpha complanata, HALL. In error. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 38, figs. 1–16. 1883.
Modiomorpha planulata, " Prelim. Notice Lamellibranchiata, 2, p. 74. 1870.

SHELL larger than the medium size, rhomboid-ovate, oblique; length less than twice the height; basal margin nearly straight, or very slightly concave anterior to the middle, curving to the anterior and posterior extremities; posterior margin abruptly curving below and more gently recurving toward the cardinal line; cardinal margin arcuate. Anterior end narrow, extended, abruptly curved on the margin; somewhat defined by the sinus which extends from anterior to the beak to the middle of the shell.

Valves moderately convex; in old shells gibbous in the umbonal region.

Hinge-line oblique, extending to about the middle of the length of the shell.

Beaks appressed, situated a little more than one-fourth the length of the shell from the anterior end. Umbonal region not defined; convex in young shells, becoming more gibbous in older individuals.

Test of moderate thickness, concentrically striated with irregular lines of growth which are sometimes elevated into concentric ridges. The post-cardinal slope in well-preserved specimens shows fine vascular markings similar to those on *Sphenotus solenoides*.

The anterior muscular impression is well marked and situated just within the anterior margin below the beak. Other interior characters unknown.

The specimen fig. 13 of plate xxxviii preserves the ligament connecting the two valves.

Three characteristic specimens have the following dimensions: Length 50, 60, 91 mm.; height 29, 37 and 50 mm. respectively.

The individuals of this species from medium size upward resemble *M. concentrica* in form, but the anterior end is more produced and they do not show the regular sharp concentric striæ which mark that species. It also resembles some forms which are referred to *M. alta*, but may be distinguished by its more

elongate form, more regularly convex umbonal slope, more regularly rounded posterior extremity, and narrower anterior end.

This is probably the species described by Mr. Conrad as *Cypricardites mytiloides*, of which he gives the following description:

"*C. mytiloides.* Ovate, slightly ventricose; lines of growth prominent; umbo prominent; dorsal margin elevated; anterior basal margin very oblique and slightly contracted; posterior side profoundly dilated and the margins regularly rounded. *Locality.* Near Ogden's Ferry, tab. of form. No. 23."

Formation and localities. In the shales of the Hamilton group; principally in the eastern and central portion of the State, on the shores of Seneca and Cayuga lakes.

Modiomorpha alta.

PLATE XXXVII, FIGS 1, 2 (4, 5, 6?), 7-12, 15, 16; AND PLATE LXXX, FIG. 7.

Cypricardites alta, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 52. 1841.
Modiomorpha alta, (Conrad) Hall. Prelim. Notice Lamellibranchiata, 2, p. 75. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 37, figs. 1–16; pl. 80, fig. 7. 1883.

Shell larger than the medium size, broad, rhomboid-ovate; length one-third greater than the height; the basal margin for two-thirds of its length from the anterior curve is nearly straight, varying from slightly concave to nearly straight, abruptly curving at the post-basal extremity, and continuing to the post-cardinal margin in an oblique, gently curved outline. In some examples the posterior margin is regularly curved, cardinal margin sometimes forming a nearly straight line, usually gently arcuate. Anterior end produced beyond the beak from one-sixth to one-fourth the length of the shell, obliquely truncated, obtuse, rounded below; its greatest extension is below the middle of the shell.

Valves convex, gibbous on the umbonal and medial portions of the shell; the umbonal ridge is gibbous and arched upward; the point of greatest convexity is about the middle of the shell or a little posterior. The depth of both valves is equal to two-thirds of the height of the shell.

Hinge-line straight, oblique, extending for less than half the length of the shell.

Beaks rounded, somewhat appressed, directed forward. Umbonal region not strongly defined, depressed anteriorly, becoming gibbous in the middle of the shell, gradually merging into the general contour in the posterior portion.

Test of moderate thickness, marked by irregular concentric striæ, which become fasciculate and produce strong concentric ridges at irregular intervals. The surface is marked by fine vascular lines, similar to those referred to in *M. mytiloides*. The anterior muscular impression is situated close to the anterior margin of the shell, with a small retractor scar above it. Other characters of the interior unknown.

The type specimen has a length of 68 mm., and a height of 46 mm. Three other specimens measure respectively, 65, 55 and 67 mm. in length, and 45, 37 and 42 mm. in height.

This species has a greater proportional height than *M. mytiloides*, a broader and often sub-truncate posterior end, while the anterior end is usually broader and less extended; the umbonal ridge is arcuate; in other features it is very similar. The form does not attain so large a size as *M. macilenta;* it is more ventricose in the umbonal region, the hinge-line is longer and the striæ are more irregular. In some of its conditions this species approaches *M. mytiloides*, and it is not always easy to distinguish them.

This species shows a tendency to assume extremely gibbous and sometimes distorted forms, as shown in fig. 2 of plate xxxvii and fig. 7 of plate lxxx. The specimen fig. 15 of plate xxxvii, is the type of this species.

Formations and localities. In the shales of the middle portions of the Hamilton group at many localities in the eastern and central part of the State, and especially on the shores of Seneca and Cayuga lakes; in the Hamilton group at the Falls of the Ohio, and Charleston, Indiana. Small individuals having the characteristics of this species occur in the Marcellus shales near Skaneateles, N. Y.

Modiomorpha macilenta.

PLATE XXXVII, FIG. 17; AND PLATE XXXIX, FIGS. 17-21.

Modiomorpha macilenta, Hall. Prelim. Notice Lamellibranchiata, 2, p. 76. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 37, fig. 17; pl. 39, figs 17–21. 1883.

Shell large, rhomboid-ovate; length one-third greater than the height; basal line nearly straight for more than half its length and abruptly curving both anteriorly and posteriorly. Posterior end oblique, more gently curving from the post-basal margin to the cardinal line, which is oblique and arcuate. Anterior end short, rapidly declining and abruptly rounded below.

Valves moderately convex; greatest convexity in the umbonal region, gradually merging into the general convexity of the valves.

Hinge-line extending about half the length of the shell, slightly arcuate.

Beaks small, sub-anterior, appressed, scarcely rising above the cardinal line.

Test thin, marked by regular concentric striæ which are scarcely fasciculate on any portion of the shell. The surface shows the irregular vascular markings of other species of this genus, and of some of the species of Sphenotus.

The anterior muscular impression is strong, situated a little anterior to the beak and just within the margin of the valves.

Three specimens have the following dimensions respectively: Length 90, 102, 108 mm.; height 60, 65 and 75 mm.

All the individuals which have been recognized as of this species are of comparatively large size, and bear considerable resemblance to the larger individuals of *M. alta*, but may in general be distinguished by their less convex valves, less defined umbonal ridge, usually more rounded posterior extremity, and finer and more regular concentric striæ.

The typical forms here recorded under the specific designations of *M. mytiloides*, *M. alta* and *M. macilenta*, are easily distinguishable; but in the study of large collections we find so many intermediate forms that it becomes difficult, if not impracticable, to arrange them under these several designations.

Formation and localities. In the soft calcareous shales of the Hamilton group, shores of Canandaigua lake, North Bristol, Ontario county; Bellona, Yates county; and York, Livingston county, N. Y.

Modiomorpha arcuata.

PLATE XXXVI, FIG. 21.

Modiomorpha arcuata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 36, fig. 21. 1883.

Shell of medium size, obliquely sub-spatulate or narrowly and obliquely elongate-ovate; length more than twice the height; basal margin arcuate, the greatest concavity a little more than one-third of the length from the anterior end; post-basal extremity abruptly rounded and more gently recurving to the cardinal margin, which is nearly straight and extends for about one-half the length of the shell. Anterior end produced, nasute, the margin abruptly rounded, limited by a sinus which extends to the base, more than one-third the length of the shell from the anterior end.

Valves depressed convex in the posterior half, becoming gibbous and subangular on the anterior half.

Hinge-line oblique, straight, extending for less than half the length of the shell.

Beaks small, sub-anterior, pointed, closely appressed and angular. Umbonal region prominent, gibbous, sub-angular, the angularity extending for more than two-thirds the length of the shell.

Test thin, with fine, thread-like concentric striæ. The striæ coalesce, scarcely forming fascicles along the base and cardinal slope. Anterior muscular impression sub-circular, close within the anterior margin of the shell.

The specimen described has a length of .66 mm., and a height of 25 mm.

This species is narrower and more elongate than any other form of the genus, and is only approached by some of the extreme varieties of *M. concentrica*. It bears very little resemblance to any known species found in the rocks of this age, and is an extremely rare form, a single specimen only having occurred in all the collections made in this horizon.

Formation and locality. In the harder arenaceous shales of the Hamilton group at Bear's gulf, Schoharie county, N. Y. It is associated with *Spirifera mucronata*, *Rhynchonella congregata*, and *Chonetes coronata*.

Modiomorpha cymbula.

PLATE XXXVI, FIGS. 19, 20.

Modiomorpha cymbula, Hall. Prelim. Notice Lamellibranchiata, 2, p. 75. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 36, figs. 19, 20. 1883.

Shell of medium size, elongate, sub-elliptical; length a little more than twice the height; basal margin regularly convex, acutely rounded at both extremities; cardinal line regularly curving from the beaks to the posterior extremity. Anterior end narrow, sub-nasute, without special limitation.

Valves moderately and regularly convex, the greatest convexity being about the middle of the length.

Hinge-line oblique, curving; length a little less than half the length of the shell.

Beaks sub-anterior, small, narrow, acute, closely appressed. Umbonal region moderately convex, without any defined ridge, but the prominence extends parallel to the cardinal line for more than two-thirds the length of the shell. The anterior side of the umbonal region is flattened or depressed in the cast, the depression extending downward nearly to the base, but not affecting the margin.

Test comparatively thick; surface markings not preserved. The anterior muscular impression is strong and large, with a small and deep retractor scar. Pallial line parallel with the basal margin, abruptly recurving at the posterior end and terminating in a large, shallow posterior adductor impression.

The specimen has a length of 60 mm., and a height of 28 mm.

This form is more elliptical than any of the preceding species of the Hamilton group, but is not so symmetrically elliptical as *M. regularis* and *M. linguiformis* of the Helderberg limestone. It is distinguished from all the species of the genus by its narrow and acute anterior and posterior extremities. The species is of extremely rare occurrence, a single specimen only having been observed in all the collections.

Formation and locality. In the arenaceous shales of the Hamilton group, at East Worcester, Otsego county, N. Y., associated with characteristic Hamilton fossils.

Modiomorpha subalata.

PLATE XXXV, FIGS. 6, 7; AND PLATE XXXIX, FIGS. 1–14, 16.

Cypricardites subalata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 83. 1841.
Modiomorpha subalata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 77. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 39, figs. 1–14, 16. 1883.

Shell of medium size or smaller, sub-quadrangular, or sub-ovate; sub-alate posteriorly, with the extremity obliquely truncate; length more than one-third greater than the height; basal margin straight or slightly concave on the anterior half, and thence regularly curving to the post-basal extremity; posterior margin abruptly recurved below, and continuing with a gentle curvature, or in a nearly straight line, to the cardinal margin; cardinal margin oblique, nearly straight; post-cardinal area sub-alate. Anterior end short, abruptly rounded, often a little concave below the beaks, and limited by a more or less defined sinus, which extends from the beak to the basal margin, usually at a point less than one-third the length of the shell from the anterior end.

Valves moderately convex below and in the posterior portion, more convex in the middle.

Hinge-line oblique, about half the length of the shell.

Beaks sub-anterior, incurved and directed forward, somewhat compressed. Umbo prominent, flattened anteriorly; the post-umbonal slope angular, gibbous above and gradually declining to the post-basal extremity, which is sometimes obtusely angular.

Test thin, marked by fine concentric striæ, which are sometimes fasciculate, forming distinct elevations upon the posterior slope, and often distinct angular striæ upon the antero-basal portion of the shell, frequently becoming nearly obsolete on the umbonal region.

Anterior muscular impression circular, of moderate strength; other interior characters undetermined.

A medium-sized specimen has a length of 38 mm., and a height of 23 mm. A large individual measures 53 mm. in length and 29 mm. in height.

This species differs from any of the preceding forms in the more nearly parallel cardinal and basal margins, in the angular umbonal ridge, more direct truncation of the posterior end, and the obsolescence of the striæ on the umbonal region. As compared with *M. rigida* the basal margin is straighter, the anterior end is wider, and the cardinal line less oblique.

Formation and localities. In the middle and upper portions of the Hamilton group, at numerous localities in the central and western part of the State.

Modiomorpha subalata, var. Chemungensis, n. var.

PLATE XLI, FIGS. 5, 6, 8, 9, 11 (7, 10?); AND PLATE XXXIX, FIG. 15.

Modiomorpha rigida, in part, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 10, 11. 1883.

This variety includes the specimens from the Chemung group, and presents the principal characteristics of the species. The forms are longer in proportion to their height, the cardinal line less oblique, the posterior extremity usually more rounded, the umbonal slope more arcuate, and the striæ are filiform, sharper and more regular. Although presenting these differences, it does not appear advisable to propose a distinct specific name.

The specimens present considerable variety among themselves, as is seen by reference to figs. 6, 7 and 10 of plate xli as compared with figs. 5 and 11 of the same plate. A larger collection of specimens may afford the means of a more positive separation of these forms from those of the Hamilton group.

Formation and localities. In the lower portion of the Chemung group, at Ithaca and Cortland, N. Y.

Modiomorpha affinis, n. sp.

PLATE XXXVII, FIGS. 13, 14; AND PLATE XXXV, FIG. 13.

Modiomorpha alta, in part (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 37, figs. 13, 14. 1883.

Shell large, robust, obliquely ovate, arcuate; length about one-third greater than the height; basal margin straight or slightly arcuate, curving rather

abruptly both at the anterior and posterior extremities; posterior margin abruptly curving below and more gently forward to the cardinal margin; cardinal margin arcuate from the beaks to the post-cardinal extremity. Anterior end short, scarcely defined, narrow, declining from the hinge-line and regularly rounded below.

Valves convex, very gibbous in the middle and umbonal region; depth more than half the height of the shell. The umbonal elevation extends from the beaks, curving above the middle, to near the post-basal margin, forming an undefined arcuate ridge.

Hinge-line oblique, extending more than one-third the length of the valves.

Beaks small, sub-anterior, closely incurved.

Test comparatively thick, marked by fine concentric striæ, which are fasciculate and raised into strong abrupt ridges upon the umbonal and anterior portions of the shell. Interior unknown.

The principal specimen described has a length of 70 mm., height 41 mm., and a depth in both valves of 29 mm. A smaller specimen referred with some doubt to this species has a length of 50 mm., height 32 mm., depth 21 mm. This specimen shows a strong anterior muscular impression with an accessory pit, and also a shallow posterior muscular scar on the post-cardinal slope.

This form resembles *M. alta*, but is more elongate, distinctly arcuate; the anterior end is narrower below the beaks; the posterior end is more produced and curving more abruptly forward in the upper part, with the post-cardinal angle rounded. The anterior end is less produced than in typical forms of *M. mytiloides*.

Formation and localities. The original specimen is recorded as coming from a compact limestone in the Hamilton group of Onondaga county, N. Y. The small specimen referred to is from the Hamilton group in Clarke county, Ind.

Modiomorpha recta, n. sp.

PLATE XXXV, FIG. 9.

Shell of medium size, sub-ovate; length less than twice the height; basal margin nearly straight, or gently convex, curving abruptly at the anterior and posterior extremities. Posterior end somewhat abruptly rounded. Cardinal margin nearly straight. Anterior end short, abruptly rounded at the extremity; indistinctly limited by a broad flattening of the valves extending from the umbo to the base of the shell, about one-third the length from the anterior end.

Valves very convex, gibbous on the middle and umbonal regions, somewhat abruptly declining toward the anterior and posterior extremities; depth less than one-half the length of the shell.

Hinge-line straight, slightly oblique, a little less than half the length of the shell.

Beaks sub-anterior, small, closely appressed. Umbonal region gibbous to about the posterior third, thence regularly declining to the margin.

Test of moderate thickness, concentrically striated.

Anterior muscular impression strong, with an accessory muscular pit. Pallial line not deeply impressed, following the general course of the basal margin, recurving at the posterior extremity, and terminating in a broad posterior muscular impression. The space between the pallial line and umbonal region is marked by pitted vascular lines.

One of the specimens described has a length of 57 mm., height 32 mm., and depth of both valves 25 mm. Another specimen measures 52 mm. in length and 30 mm. in height.

The general form of the shell is similar to *M. subalata*, but it has not the distinct umbonal ridge, nor alate post-cardinal slope.

Formations and localities. In the cherty-layers of the Hamilton group, in Clarke county, Ind.; and in the Corniferous limestone of Canada West.

Modiomorpha subangulata, n. sp.

PLATE XXXV, FIGS. 10, 11.

Shell of medium size, elongate sub-ovate, wider behind; length more than twice the height; basal margin slightly arcuate, abruptly rounding at the extremities; posterior margin acutely rounded below and obliquely subtruncate to the cardinal line; cardinal margin nearly straight. Anterior end rapidly declining from the beak and abruptly rounded below.

Valves moderately convex in the posterior part, and gibbous and subangular in the umbonal region. There is a broad depression or sinus which extends from just posterior to the beak to the basal margin near the middle of the length of the shell.

Hinge-line slightly oblique, extending about half the length of the shell.

Beaks almost anterior, prominent, small, angular, incurved and elevated above the hinge-line. Umbonal region gibbous, with a prominent ridge extending from the beaks to the post-basal extremity, angular in its upper portion, becoming more subdued toward the posterior end.

Test thick, marked by fine concentric striæ, which are sometimes fasciculate, making stronger ridges on the surface. Anterior end marked by a strong, muscular impression just below the beak, close to the anterior margin.

A large individual of this species has a length of 55 mm., and a height of 26 mm. A smaller specimen has a length of 39 mm., and a height of 19 mm.

This species bears some resemblance to *M. subalata*, but differs in its much stronger and more angular umbonal ridge, which reaches to the post-basal extremity, the basal margin is more arcuate, the cardinal and basal margins are more nearly parallel, and the anterior end is shorter.

Formation and locality. In the Chemung group, Mansfield, Tioga county, Pa.

Modiomorpha rigida.

PLATE XLI, FIGS. 14-16.

Modiomorpha rigida, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 10, 11, 14–16 (figs. 10, 11 in error). 1883.

Shell of medium size or smaller, sub-rhomboid-ovate; length nearly twice the height; basal margin regularly and gently curving from the anterior

end to the post-basal extremity, abruptly recurving and extending thence in a nearly direct line to the cardinal margin; cardinal margin nearly straight. Anterior end short, rounded, without any indication of limitation by a sinus or otherwise.

Valves moderately convex, scarcely gibbous in the umbonal region.

Hinge-line straight, extending about half the length of the shell.

Beaks sub-anterior, small, closely appressed, rising but little above the hinge-line. Umbonal region defined, sub-angular; the slope straight and rigid, extending from the beaks to the post-basal extremity.

Test thin, marked by fine concentric striæ, which are rarely fasciculate and elevated into ridges. Interior unknown.

A medium-sized specimen has a length of 41 mm., and a height of 22 mm. A smaller specimen measures 30 mm. in length and 17 mm. in height.

This species bears some resemblance to *M. subalata*, but is less alate on the posterior slope; the umbonal ridge is more direct, the post-basal extremity is directed more downward, basal margin more regularly convex and without evidence of a sinus.

The original reference of figs. 10 and 11 of plate xli to this species is erroneous, those figures representing the Chemung variety of *M. subalata*.

Formation and localities. In the sandstones of the Chemung group, near Angelica; and at Rock creek, Alleghany county, N. Y.

Modiomorpha recurva.

PLATE XLI, FIG. 17.

Modiomorpha recurva, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, fig. 17. 1883.

Shell of medium size, ovate-sub-cuneate; length about twice the height; basal margin regularly curving to the anterior and posterior extremities. Posterior end acute, recurving very abruptly toward the cardinal line. Cardinal margin arcuate or nearly straight. Anterior end short, abruptly rounded, limited posteriorly by a very shallow and undefined sinus (which is much too strongly represented in the figure).

Valves moderately convex, except in the umbonal region, where they are somewhat gibbous in the middle.

Hinge-line slightly arcuate, extending about half the length of the shell.

Beaks small, sub-anterior, incurved. Umbonal region prominent, gradually declining to the post-cardinal slope.

Test thin, marked by fine concentric striæ. Interior unknown.

The specimen described is somewhat distorted by pressure, and has a length of 50 mm., and a height of 25 mm.

In its normal condition this species would resemble *M. subalata* and its variety, and may be compared with figs. 5, 10 and 11 of plate xli. The shell is nearly all exfoliated, and the surface characters are thereby rendered obscure.

Formation and locality. In the arenaceous shales of the Chemung group, at Belmont, Alleghany county, N. Y.

Modiomorpha quadrula.

PLATE XLI, FIGS. 18-26.

Modiomorpha quadrula, Hall. Prelim. Notice Lamellibranchiata, 2, p. 77. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 18-26. 1883.

Shell small, quadrangular or rhomboidal, varying in length and height from nearly equal to almost twice as long as wide; basal margin nearly straight or slightly convex, curving abruptly into the anterior and posterior margins. Posterior extremity sub-truncate, sometimes nearly at right angles to the basal line. Cardinal margin nearly straight or gently curved. Anterior end declining abruptly from the beaks, narrow and abruptly rounded, not limited by any defined sinus.

Valves moderately convex toward the basal and posterior margins, slightly gibbous in the umbonal region.

Hinge-line scarcely oblique, extending two-thirds the length of the shell.

Beaks sub-anterior, small and closely appressed. Umbo rising above the hinge-line and extending in a more or less defined obtusely angular ridge to the post-basal extremity.

Test thin, finely striated concentrically, with rarely any evidence of fasciculation.

Anterior muscular impression large, situated just within the anterior margin of the shell. Posterior scar superficial.

A specimen of medium size has a length of 20 mm., and a height of 14 mm. A more elongate form has a length of 20 mm., and a height of 12 mm. A large symmetrical specimen has a length of 30 mm., and a height of 20 mm.

This is a small species of quadrangular form, but subject to much variation in its proportions, depending chiefly on the manner in which the lateral compression has been directed, whether in the line of the longitudinal or vertical axis of the shell; those lying in one direction on the surface of the shale being lengthened, and those at the right angles being considerably widened and shortened.

This species differs from any of the foregoing in its small size, quadrangular form, well-defined, straight, sub-angular umbonal ridge. The specimens, although imbedded in a fine micaceous sandy shale, have had their surface characters almost entirely destroyed by the deposition of sand, which has become incorporated with the shell, giving the surface a roughly granulose texture.

Formation and localities. In the micaceous sandy shales of the Chemung group, at Belmont and Rockville, in Alleghany county; and in Cattaraugus county, N. Y.

Modiomorpha neglecta.

PLATE XLI, FIG. 13.

Modiomorpha neglecta, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 12, 13. 1883. (Fig. 12 in error.)

Shell small, ovate, wider behind; length and height as 3 to 2; basal margin straight in the middle, curving abruptly both at the anterior and posterior extremities; posterior margin regularly rounded, curving into the cardinal margin, which is gently arcuate. Anterior end very short, declining abruptly from the beaks, and regularly rounded below; obscurely limited by a depression extending from the beaks to the basal margin.

Valves moderately convex in the posterior part, gibbous in the middle and umbonal region.

Hinge-line short, oblique, about one-third the length of the shell.

Beaks anterior, prominent, small, distinct. Umbonal slope rounded, flattened on the anterior side.

Test thin, marked by fine concentric striæ. Interior unknown.

The specimen described has a length of 24 mm., and a height of 15 mm.

This form is distinguished from *M. subalata*, var. *Chemungensis*, by the absence of defined umbonal ridge, and in the regularly rounded posterior extremity.

Formation and locality. In the Chemung group, Buck's quarry, near Elmira, N. Y., associated with *Orthis impressa*, *Atrypa hystrix*, and *Productella Boydi*.

Modiomorpha Tioga, n. sp.

PLATE XL, FIG. 18.

Modiomorpha? amygdalina (Winchell, sp.), Hall. Prelim. Notice Lamellibranchiata, 2, p. 78. 1870.
In part " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 15–19. 1883.
Not *Sanguinolites amygdalinus*, Winchell. Proc. Acad. Nat. Sci. Phila., p. 13. 1863.

Shell of medium size, sub-ovate, wider behind, sub-truncate at both extremities; length one-half greater than the height; basal margin slightly sinuate in the middle, curving toward the extremities, and abruptly rounded into the anterior and posterior margins. Posterior margin sub-truncate in the upper portion. Anterior end declining abruptly from the beak and narrowly rounded in front, limited by an obscure depression extending from the beak to the basal margin.

Valves depressed-convex posteriorly and in the lower part, moderately convex in the umbonal region.

Hinge-line imperfect in the specimen described.

Beaks situated a little less than about one-fourth the length of the shell from the anterior end, small, closely appressed, rising very little above the hinge.

Test thin, marked by fine concentric striæ, which, in some parts, have

become lamellose. Anterior muscular impression shallow, situated just within the anterior margin.

The specimen described has a length of 50 mm., and a height of 27 mm.

This species bears some resemblance to *M. mytiloides*, but the beak and umbonal region are much less prominent, the anterior end is broader and the body of the shell does not expand so rapidly toward the posterior end, making the hinge-line less oblique.

Formation and locality. In the Chemung group, Mansfield, Tioga county, Pa.

Modiomorpha hyalea.

PLATE XLI, FIGS. 28-30.

Modiomorpha hyalea, Hall. Prelim. Notice Lamellibranchiata, 2, p. 79. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, figs. 28–30. 1883.
" ? " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 5–11 (erroneous reference). 1883.

Shell larger than the medium size, sub-elliptical; length nearly twice the height; basal margin nearly straight, or slightly arcuate near the middle, recurving somewhat abruptly at the extremities. Posterior end abruptly rounded, obliquely sub-truncate above, and curving into the cardinal line. Cardinal margin nearly straight, and parallel to the basal margin of the shell. Anterior end gently declining from the beaks, produced, and abruptly rounded below; not limited.

Valves moderately convex in the lower and posterior part, becoming more convex and scarcely gibbous in the umbonal region.

Hinge-line straight, less than half the length of the shell.

Beaks broad, moderately prominent, curving over the hinge-line, situated a little less than one-third the length from the anterior end. Umbonal region prominent, scarcely gibbous; the ridge prominent and rounded but not gibbous.

Test thin, marked by closely arranged concentric striæ, with occasional stronger undulations which are more frequent on the umbonal region. Muscular impressions unknown. Surface of the cast for some distance within

the pallial line marked by radiating vascular striæ. (These striæ, by mistake in the figure, are continued over the umbonal region, where they do not exist.)

Three specimens have the following dimensions respectively: Length 51, 68 and 70 mm., height 26, 35 and 37 mm.

This species bears some resemblance in its general form to *M. Tioga*, but the anterior end is more produced, the posterior extremity less regularly rounded, and the surface markings are more rigid and less lamellose. The reference of figs. 5–11, plate xl, to this species, in the Plates and Explanations, cited above, arose from copying an erroneous record, without comparison; the specimens do not belong to the genus MODIOMORPHA.

Formation and locality. In the Waverly sandstone, Granville, Licking county, Ohio.

GONIOPHORA, PHILLIPS. 1848.

GONIOPHORA PERANGULATA.

PLATE XXXIV, FIGS. 1-6; AND PLATE XLII, FIGS. 1-2.

Sanguinolites perangulatus, HALL. Prelim. Notice Lamellibranchiata, 2, p. 35. 1870.
" " " S. A. MILLER. Cat. Amer. Pal. Foss., p. 203. 1877.
Goniophora perangulata, HALL. S. A. MILLER. Cat. Amer. Pal. Foss., p. 192. 1877.
" " " Pal. N. Y., vol. 5, pt. 1. Plates and Explanations: Pl. 34, figs. 1–6. 1883.

SHELL of medium size or smaller, trapezoidal; length equal to twice the height; basal margin regularly curving for the greater part of its extent with an undefined sinuosity about the anterior third of the length, and a slight constriction near the posterior extremity; posterior margin obliquely truncate to the cardinal line, which is nearly straight. Anterior end short, abruptly rounded below, sometimes obscurely limited by an undefined depression extending from the beak to the base of the shell.

Valves convex, gibbous in the anterior portion, abruptly declining to the basal and post-basal margins.

Hinge-line nearly straight, slightly ascending from the anterior end, equalling half the length of the shell.

Beaks anterior, small, acute, closely incurved. Umbo acutely angular; umbonal ridge, with a slightly downward curve, extending to the post-basal

extremity. Between the umbonal ridge and the cardinal line the shell is concave.

Test of moderate thickness. Surface marked by fine regular concentric striæ, which are sometimes thickened on the lower side of the shell. In a well-preserved specimen the valves below the umbonal angles are marked by fine radiating striæ, which are more conspicuous posterior to the sinus. The test on the umbonal ridge is elevated into a sharp crest.

Anterior muscular impression immediately below the beaks and close to the anterior margin of the shell. Pallial line not deeply impressed. Posterior muscular scar strong, situated on the cardinal slope near the margin, leaving a shallow groove in its advance from just behind the beaks. Ligamental groove very strong.

A specimen of medium size has a length of 46 mm. and a height of 24 mm. A smaller individual measures 43 mm. in length and 20 mm. in height.

In its anterior beaks and narrow posterior end this species resembles *G. acuta*, but the cardinal line is much shorter than in that form, the basal margin is less strongly sinuate and the umbonal ridge is not regularly arcuate. Compared with *G. truncata*, the umbonal ridge is more distinctly curving, the cardinal slope is concave, the radii are finer and more closely arranged.

Formation and locality. In the Schoharie grit, at Schoharie, N. Y.

Goniophora? alata, n. sp.

PLATE XXXIV, FIG. 7; AND PLATE XLII, FIG. 3.

Shell large, trapezoidal; length less than twice the height; basal margin nearly straight; posterior margin very broad, truncate; anterior end short, small, limited posteriorly by an undefined sinus.

Valves convex below, gibbous on approaching the umbo, and depressed above the umbonal ridge, with an undefined furrow extending from a point anterior to the beaks to the posterior margin.

Hinge-line straight, oblique, about one-third the length of the shell.

Beaks anterior, small and acute. Umbo prominent, angular; the umbonal ridge continuing to the post-basal extremity.

Test marked by strong concentric striæ, which are acutely recurved upon the umbonal angle.

In the specimen figured on plate xxxv the umbonal ridge, in the middle of its length, has been accidentally flattened and the stronger striæ crossing this flattened area are preserved, showing only a gentle curve in their direction instead of sharply recurving over the angular portion of the ridge.

Interior essentially unknown.

A specimen of medium size has a length of 75 mm., and a height of 45 mm. A smaller individual has a length of 60 mm., and a height of 35 mm. One large specimen has a length of 90 mm.

This species differs from all others here described in the extremely expanded and alate cardinal slope.

Formation and locality. In the Schoharie grit, Schoharie, N. Y.

Goniophora acuta.

PLATE XLIII, FIGS. 1-3.

Sanguinolites acutus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 37. 1870.
" " " S. A. Miller. Cat. Amer. Pal. Foss., p. 202. 1877.
Goniophora acuta, Hall. S. A. Miller. Cat. Amer. Pal. Foss., p. 192. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 43, figs. 1-3. 1883.

Shell large, trapezoidal, very much elongated posteriorly; length more than twice the height; basal margin straight on the posterior part with a sinus anterior to the middle, beyond which it curves into the anterior margin; posterior margin obliquely truncate; cardinal margin nearly straight, or slightly arcuate, extending nearly two-thirds the length of the shell. Anterior end short, rounded below, limited by an oblique sinus extending from the beak to the base, just anterior to the middle.

Valves convex below the umbonal ridge, depressed at the sinus, slightly concave between the umbonal ridge and the cardinal line.

Beaks anterior, small, closely incurved. Umbonal ridge angular, prominent, extending to the post-basal extremity.

Test moderately thick, marked by closely arranged sub-lamellose striæ,

which are fasciculose on the anterior portion of the shell. Radiating striæ are obscurely visible on both the specimens figured. On the umbonal ridge the test is raised into a thin crest. Interior unknown.

The principal specimen described has a length of 80 mm., and a height of about 28 mm.

This species resembles *G. Hamiltonensis*, but differs in having the beaks nearer to the anterior end, in its more elongate form, and in the radiating striæ of the surface-characters not observed in specimens referred to that species. As compared with *G. truncata*, it is a more elongate shell with a proportionally longer and less oblique hinge-line.

Formation and locality. In the soft shales of the Hamilton group, on the shores of Canandaigua lake, N. Y.

Goniophora Hamiltonensis.

PLATE XLIII, FIGS. 8-15, 17-21.

Sanguinolites Hamiltonensis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 36. 1870.
Goniophora Hamiltonensis, Hall. S. A. Miller. Cat. Amer. Pal. Foss., p. 192. 1877.
" " " Pal. N. Y., vol. v, pt, 1. Plates and Explanations: Pl. 43, figs. 8-21. 1883.

Shell large, trapezoidal; length more than twice the height; basal margin gently curving, sometimes nearly straight and slightly affected by the sinus. Posterior margin obliquely truncate. Anterior margin concave below the beak and abruptly rounded below. Cardinal line very slightly arcuate, extending for two-thirds the length of the shell; margins inflected, forming a long, deep escutcheon.

Valves moderately convex below the umbonal ridge, and concave above it to the cardinal line.

Beaks sub-anterior, small, closely incurved, situated from one-fourth to one-sixth the length of the shell from the anterior margin. Umbonal ridge angular, strongly defined, arching over the beaks and extending in nearly a direct line to the post-basal extremity. Umbonal region scarcely gibbous, separated from the anterior end by a broad undefined sinus, which becomes obsolete in some specimens, owing to compression.

Test of moderate thickness, marked by regular, prominent, lamellose striæ.

Anterior muscular impression strong, sub-circular. Inter-pallial area pustulose in the cast. Hinge thickened, carrying a single cardinal fold. Ligament extending about half the length of the cardinal line, strong and prominent, frequently preserved in specimens retaining the valves in conjunction.

The striated area, anterior to the cardinal pit (fig. 19, plate xliii), does not appear to be an organic feature of the hinge, but is probably due to the infolding and impression of the surface striæ. The hinge does not preserve striæ posterior to the beak, as shown in the figure.

Three characteristic specimens measure respectively 87, 82 and 38 mm. in length, and 39, 36 and 18 mm. in height. The smallest individual observed has a length of 10.5 mm. and a height of about 5 mm.

This species differs from *G. rugosa* in having the umbonal ridge more direct, more prominent and strongly angular; the anterior end is shorter and narrower, the posterior extremity more distinctly truncate and the surface of the shell is less rugose.

Formation and localities. In the shales of the Hamilton group, Fultonham and Bear's gulf, Schoharie county, and throughout the eastern and central portions of the State.

Goniophora rugosa.

PLATE XLII, FIGS. 7, 8*a*; AND PLATE XLIII, FIGS. 4-7.

Cypricardites rugosa, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 53. 1841.
Sanguinolites rugosus (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 37. 1870.
Goniophora rugosa, Conrad. S. A. Miller. Cat. Amer. Pal. Foss., p. 192. 1877.
" " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 43, figs. 4–7. 1883.

Shell of medium or large size, sub-rhomboidal; length less than twice the height; basal margin gently curved, flattened on approaching the anterior; posterior margin sub-truncate, gently curving from the post-basal extremity to the cardinal line. Anterior end declining rapidly from the beaks and abruptly rounded below. Cardinal line gently arcuate, slightly oblique, extending for about two-thirds the length of the shell.

Valves moderately convex below the umbonal ridge, sometimes more convex; depressed convex or nearly flat above the umbonal slope.

Beaks sub-anterior, small, closely incurved. Umbo prominent. The umbonal ridge is more or less strongly defined, extending in a slightly curving line to the post-basal extremity.

Test strong, marked by somewhat irregularly rugose or undulating lamellose striæ, which make an abrupt curvature or an angular return in crossing the umbonal ridge. Interior unknown.

Three specimens have the following respective dimensions: Length 60, 51, and 32 mm.; height 35, 29 and 18 mm.

This species is distinguished by its short form, rounded posterior extremity, and rugose surface characters.

Formation and localities. In the shales of the Hamilton group, shores of Canandaigua, Cayuga and Seneca lakes, and near Schoharie, N. Y.

Goniophora truncata.

PLATE XLII, FIGS. 9, 10; AND PLATE XLIV, FIGS. 1-5.

Goniophora truncata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 44, figs. 1-5. 1883.

Shell of medium size, trapezoidal; length more than twice the height; basal margin rounded in the anterior part, slightly sinuate a little anterior to the middle and nearly straight or slightly curving to the post-basal extremity; posterior margin obliquely sub-truncate, slightly curving. Cardinal line short, straight. Anterior end short, rounded, limited by an oblique sinus extending from the beak.

Valves convex below the umbonal ridge, gibbous in the umbonal region; the area above the umbonal ridge is flat or concave, or sometimes a little convex.

Beaks anterior, acute and incurved; umbo prominent, angular. Umbonal ridge strongly defined, acutely angular, extending to the post-basal extremity.

Test of moderate thickness; entire shell marked by fine, lamellose, concentric striæ, and that portion of the surface between the umbonal ridge and

the sinus is marked by strong, elevated, radiating striæ, which dominate the concentric striæ. The test is raised into a crest along the umbonal ridge, especially in the posterior half of its length.

Anterior muscular impression large and deep, situated close to the anterior margin, truncated posteriorly by a strong ridge or clavicle. Pallial line parallel to and near the basal margin, appearing as a shallow groove, recurving near the post-basal extremity and terminating in a broad, muscular impression, the anterior margin of which is near the center of the length of the shell.

A specimen of medium size has a length of 54 mm., and a height of 23 mm. A somewhat smaller individual measures 50 mm. in length and 20 mm. in height.

This species is very closely allied to *G. perangulata* of the Schoharie grit, and it is possible that they are identical. In the specimen fig. 3 of plate xl, the hinge-line is shorter than in specimens of *G. perangulata*, but the comparative length of the hinge-line appears to be variable in the two species. Other differences are pointed out under the description of that species.

Formation and localities. In the shales of the Hamilton group, on the shores of Cayuga and Skaneateles lakes, at Delphi and Pratt's falls, Onondaga county, N. Y.

Goniophora Glaucus.

PLATE XLIII, FIG. 16; AND PLATE XLIV, FIGS. 10-17.

Sanguinolites Glaucus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 38. 1870.
Goniophora glabra, Hall (in error). S. A. Miller. Cat. Amer. Pal. Foss., p. 192. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 44, figs. 9-17. 1883.

Shell large, trapezoidal; length once and a half greater than the height; basal margin gently curved, sometimes scarcely sinuate anterior to the middle; posterior margin obliquely truncate; cardinal line nearly straight or slightly oblique; anterior end declining from the beaks and abruptly rounded below.

Valves moderately convex below, sometimes becoming gibbous in the umbonal region.

Beaks sub-anterior, small and closely appressed; umbo prominent; umbonal ridge more or less strongly defined and distinctly angular, extending to the post-basal extremity.

Test of moderate thickness, marked by regular concentric thread-like striæ, which are abruptly recurved on the umbonal ridge; anterior muscular impression deep and strong. The pallial line extends parallel to the basal margin, and abruptly recurves over the umbonal ridge, terminating in a large shallow posterior muscular scar upon the cardinal slope. The hinge is furnished with a strong triangular fold beneath the beak of the left valve, and a corresponding depression in the right valve.

Three specimens measure respectively 90, 61 and 49 mm. in length, and 49, 39 and 28 mm. in height.

This species closely resembles *G. Hamiltonensis*, but differs principally in its proportionally shorter form, more convex basal margin and more direct umbonal ridge.

Formation and localities. In the Hamilton group, Fultonham and Bear's gulf, Schoharie county; Kelloggsville, Cayuga county, and on the shore of Cayuga lake, N. Y.

Goniophora Ida.

PLATE XLII, FIG. 13; AND PLATE LXV, FIG. 20.

Sanguinolites Ida, Hall. Prelim. Notice Lamellibranchiata, 2, p. 43. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, fig. 20. 1883.

Shell of medium size, elongate sub-elliptical; length about two and one-half times the height; basal margin regularly curved; posterior margin very obliquely truncate. Cardinal line straight, less than half the length of the shell. Anterior end gently declining from the beak, narrow, and abruptly rounded at the extremity.

Valves regularly convex; cardinal slope depressed, and abruptly concave just above the umbonal ridge.

Beaks at about the anterior third, small, appressed, slightly projecting

above the hinge-line. Umbo moderately prominent. Umbonal ridge distinctly angular, extending from the beak to the post-basal margin.

Test thin, marked by fine concentric striæ, which are more or less fasciculate on the body of the shell, and very regular and uniform on the post-cardinal slope. Interior unknown.

The right valve in the specimen figured on plate lxv, fig. 20, has a length of 49 mm. and a height of 19 mm. A larger and better-preserved specimen has a length of 59 mm. and a height of 22 mm. Another specimen referred to this species has a length of 45 mm. and a height of 18 mm.

This species differs from the others of the Hamilton group in its narrow elliptical form, the regular curving basal margin, and narrow anterior end. The hinge-line is comparatively shorter than in any of the species of the Hamilton group except *G. truncata.*

Formation and localities. In the upper portion of the Hamilton group, at Geneseo, Livingston county; at Bellona, Yates county; on the shore of Cayuga lake, and from a boulder of Hamilton shale at Sexton's, near the head of Seneca lake, N. Y.

Goniophora carinata.

PLATE XLII, FIG. 11; AND PLATE XLIV, FIGS. 6-8.

Cypricardites carinata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 53, plate, fig. 21. 1841.
Sanguinolites carinatus (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 43. 1870.
Compare *Cypricardites Chemungensis,* Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 181, 2; p. 179. 1842.

Shell of medium size or larger, trapezoidal; length more than twice the height; basal margin sinuate anterior to the middle, curving gently to the post-basal extremity and more abruptly to the anterior; posterior margin obliquely truncate. Cardinal line nearly straight and parallel with the basal margin, equal to one-half the length of the shell. Anterior end sloping gently from the beak and abruptly rounded below, limited by a broad undefined sinus which constricts the basal margin.

Valves moderately convex below the umbonal ridge, slightly concave on the cardinal slope.

Beaks situated less than one-third the length of the shell from the anterior end, closely incurved. Umbo prominent. Umbonal slope distinctly carinated and terminating at the basal extremity.

Test of moderate thickness, marked by fine undulating concentric striæ, which are aggregated into folds upon the lower and anterior part of the shell. On the cardinal slope these undulations are less prominent. Interior unknown.

Four specimens have the following dimensions respectively: Length 70, 63, 35 and 16 mm.; height 28, 26, 16 and 7 mm.

This species is comparatively longer than *G. Hamiltonensis* and *G. rugosa*, and the concentric striæ are finer and strongly fasciculate, while the anterior end is much longer. Compared with *G. Chemungensis*, the beaks are more distant from the anterior end, the umbonal ridge is slightly curved, while in that species it is very rigid; the posterior extremity is wider.

Formation and localities. In the shales of the Hamilton group, associated with *Paracyclas lirata, Chonetes scitula, Spirifera mucronata* and *Hyolithes aclis*, at Copley's quarry, Oneonta, and near Mount Upton, N. Y.

Goniophora trigona, n. sp.

PLATE XLII, FIG. 12; AND PLATE XLIV, FIG. 9.

Goniophora glabra, Hall (error for *G. Glaucus*). Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 44, fig. 9. 1883.

Shell large, trapezoidal; body sub-trigonal; length twice the height; basal margin sinuate anterior to the middle, curving gently toward the post-basal extremity and more rapidly to the anterior; posterior margin obliquely truncate; cardinal line short, essentially straight; anterior end large, sloping somewhat abruptly from the umbo and narrowly rounded below, limited posteriorly by a broad undefined sinus. Shell convex below, gibbous above; cardinal slope slightly concave, descending abruptly from the umbonal ridge and gently rising toward the cardinal line.

Beaks at about the anterior third; umbo very prominent; umbonal ridge

distinctly angular, descending in nearly a direct line to the post-basal extremity.

Test of moderate thickness; the cast is marked by fine concentric striæ, which are strongly fasciculate on the anterior portion of the shell, and regular and uniform in strength on the post-cardinal slope. Interior unknown.

The specimen described has a length of 72 mm. and a height of 35 mm.

This species, compared with any other, has a much greater elevation of the umbo above the base of the shell, a larger anterior end and a more rapid declension to the post-basal extremity. The figure of this species given on plate xliv does not correctly represent the specimen.

Formation and locality. In the Chemung group, near Franklin, Delaware county, N. Y.

Goniophora Chemungensis.

PLATE XLIV, FIGS. 18, 20, 22.

Cypricardites Chemungensis, Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 181, fig. 2; p. 179. 1842.
Sanguinolites Chemungensis, " S. A. Miller. Cat. Amer. Pal. Foss., p. 202. 1877.
Goniophora Chemungensis (Vanuxem), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 44, figs. 18–22. 1883.
Cypricardites carinifera, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 245, pl. 13, fig. 14. 1842.

Shell large, trapezoidal; length two and one-half times the height; basal margin very gently curving, nearly straight, or slightly sinuate anterior to the middle; posterior extremity obliquely truncated. Cardinal line straight, parallel to the base, extending for nearly two-thirds the length of the shell. Anterior end sloping rapidly from the beak and abruptly rounded below, limited by a very oblique, narrow, undefined sinus, which reaches the base more than one-third of the length from the anterior end.

Valves moderately convex on the lower side, becoming gibbous in the umbonal region. Post-cardinal slope flat or slightly concave.

Beaks sub-anterior, small and closely incurved, situated less than one-fourth the length of the shell from the anterior extremity. Umbo prominent. Umbonal ridge distinctly angular, extending in a direct line or with a gentle curvature to the post-basal extremity.

Surface marked by fine, concentric striæ, which become fascicled and form strong undulations on the anterior end of the shell. The striæ are acutely recurved on passing the umbonal ridge. Interior unknown.

Three specimens measure respectively, 75, 63 and 55 mm. in length, and 28, 25 and 22 mm. in height.

Compared with *G. carinata* the anterior end is proportionally shorter, the sinus more oblique, the posterior end narrower, and the recurving of the striæ over the umbonal ridge is much more abrupt.

The specimen fig. 18 of plate xliv is the typical specimen figured by Vanuxem *loc. cit.*

Formation and localities. In the Chemung group, near Owego, Binghamton and Chemung Narrows, N. Y.

Goniophora subrecta, n. sp.

PLATE XLII, FIGS. 14, 15; AND PLATE XLIV, FIGS. 19, 21.

Goniophora Chemungensis (Vanuxem), Hall (in error). Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 44, figs. 19, 21. 1883.

Shell large, trapezoidal; length more than twice the height; basal margin gently curving, with a slight sinuosity anterior to the middle; posterior margin obliquely truncate, very gently curving; cardinal line straight, parallel to the base, having a length of less than two-thirds the entire length of the shell; anterior end gradually declining from the beak, abruptly rounded below, and limited by an obscure sinus, which reaches the base at about the anterior third.

Valves moderately convex below the umbonal ridge, scarcely gibbous in the umbonal region; cardinal slope broad and essentially flat.

Beaks sub-anterior, small and closely incurved. Umbo prominent; umbonal ridge angular, slightly curving downward and extending to the post-basal extremity.

Test concentrically striated. The striæ above the ridge are simple and continuous, and below they are aggregated into fascicles. Interior unknown.

Three specimens measure respectively 82, 57 and 50 mm. in length, and 32, 21 and 21 mm. in height.

This species more nearly resembles *G. carinatus*, but the anterior end is proportionally shorter, the sinus not so strongly marked, the post-cardinal slope broader, and the striæ not so abruptly recurved in passing the umbonal ridge. From *G. Chemungensis* it differs in its wider posterior end, the gentle downward curving of the umbonal ridge, the wider cardinal slope and the less abrupt recurving of the striæ in passing the umbonal ridge. It is easily distinguished from the last-mentioned species by these characteristics.

Formation and localities. In the Chemung group, Franklin, Delaware county; and at summit of hill, east of Charlottesville, and at Jefferson, Schoharie county, N. Y.

Goniophora minor, n. sp.

PLATE XLII, FIGS. 4-6.

Shell small, trapezoidal; length about one-third greater than the height; basal margin gently convex on the anterior half, becoming straight or slightly arcuate behind; posterior margin obliquely truncate. Cardinal line straight, about two-thirds the length of the shell. Anterior end narrowly rounded below the lunule.

Valves convex below, becoming gibbous in the umbonal region.

Beaks sub-anterior, closely incurved. Umbo prominent, angular. Umbonal ridge sharply angular, continued to the post-basal extremity, and carrying a conspicuous crest. Post-cardinal area slightly convex.

Surface marked by strong, regular, concentric striæ, which are less conspicuous on the post-cardinal area. One specimen shows indications of fine, radiating striæ on the posterior half of the valve.

Anterior muscular impression strong, situated just within the anterior extremity.

Two characteristic specimens have respective lengths of 12 and 11 mm., and heights of 8 and 7 mm. A comparatively shorter form has a length of 9 mm., and a height of 7 mm.

This species is much smaller than any form here described. It somewhat resembles *G. truncata*, but differs in its greater proportional height, the area between the carina and hinge-line is more convex; the concentric striæ are much stronger and the indications of radiating striæ are quite obscure.

Formation and locality. At the base of the Chemung (Ithaca group) at Ithaca, N. Y.

MICRODON, Conrad. 1842.

CYPRICARDELLA, Hall. 1858.

EODON, Hall. 1877.

MICRODONELLA, Œhlert. 1881.

Microdon (Cypricardella) major, n. sp.

PLATE XLII, FIG. 21.

Shell large, rhomboid-ovate; length one-third greater than the height; basal margin regularly curving; more abruptly recurving at the anterior end and less abruptly at the posterior; posterior margin sub-truncate, slightly curving; cardinal margin oblique, nearly straight. Anterior end broadly rounded.

Valves moderately convex, not gibbous.

Beaks, at about the anterior fourth of the shell, appressed. Umbonal region distinctly convex, declining in an undefined ridge to the post-basal angle.

Test comparatively thick, marked by strong, regularly rounded concentric striæ, which are abruptly recurved on the post-umbonal slope. Interior unknown.

The specimen described has a length of 73 mm., and a height of 50 mm.

As compared with *M. bellastriata* it is a much larger form, with broader anterior end, more extended at the post-basal extremity and the striæ more abruptly recurving over the umbonal slope. In the extension of the post-basal extremity it resembles *M. complanata*, but in other respects it is quite different.

Formation and locality. In the Corniferous limestone of the Upper Helderberg group, at Delaware, O.

Microdon (Cypricardella) bellistriatus.

PLATE XLII, FIGS. 17-20; PLATE LXXIII, FIGS. 7-22; AND PLATE LXXIV, FIGS. 5-10.

Microdon bellastriata, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 247, pl. 13, fig. 12. 1842.
" " " Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 196, fig. 2. 1843.
" " " Rogers. Geol. Pennsylvania, p. 827. 1868.
" " " Hall. Twenty-third Rept. N. Y. State Cab. Nat. Hist., pl. 14, fig. 8. 1873.
" " " " Prelim. Notice Lamellibranchiata, 2, p. 31. 1870.
Eodon bellistriatus (Conrad). S. A. Miller. Cat. Amer. Pal. Foss., p. 244. 1877.
Microdonella bellistriata (Conrad), Œhlert. Mem. Geol. Soc., France, Third Ser., tom. ii, p. 27, pl. 4, figs. 4a, 4b. 1881.
Microdon (*Microdonella*) (*Eodon*) *bellistriatus* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 73, figs. 7-22; pl. 74, figs. 4-10. 1883.
Compare *Sanguinolaria lamellosa*, Goldfuss. Petrefacta, vol. ii, p. 279, pl. 59, fig. 12. 1834-1840.

Shell of medium size or larger; form sub-rhomboidal to sub-elliptical; proportions of length and height extremely variable, varying from a length of twice the height, to a length of less than one-third greater than the height; basal margin regularly curving anteriorly, often nearly straight in the posterior half; posterior margin almost vertically sub-truncate, sometimes gently curving. Cardinal line nearly straight, sometimes slightly declining posteriorly, often arcuate. Anterior end narrowed, prolonged below and abruptly rounded at the extremity; constricted above by a distinct lunule.

Valves depressed-convex, becoming moderately convex in the umbonal region.

Beaks usually at about the anterior third, but often nearer the anterior extremity, small, closely appressed, scarcely rising above the hinge-line. Umbo sometimes moderately convex. Umbonal slope continued as a low undefined ridge to the post-basal angle.

Test of moderate thickness, marked by strong, even, angular striæ, which continue of nearly uniform character over the entire shell, and are subdued in specimens from the softer shales.

Anterior muscular impression strong; posterior one superficial. Left valve marked by a strong oblique fold or tooth, with a corresponding cavity in the right valve. Posterior to this cavity are one or more obscure folds. No lateral teeth proper have been observed.

Six characteristic specimens have the following dimensions, respectively: Length 46, 37, 35, 37, 28 and 38 mm.; height 27, 22.5, 25, 28, 21 and 31 mm.

This species differs from *M. gregarius* in its broader cardinal slope, less oblique posterior margin, larger size and stronger surface striæ. *M. complanatus* is a larger and more elongate form, the posterior and anterior extremities more regularly curved, the striæ irregular and fascicled, the beaks more elevated and the posterior margin more obliquely truncate.

Formation and localities. In the shales of the Hamilton group throughout the range of this formation in the State of New York, but more abundant in the eastern and central portions; also from the same horizon, near Cumberland, Md.; and in the Chemung group, near Elmira and Ithaca, N. Y.; and from Susquehanna and Tioga counties, Pa.

Microdon (Cypricardella) gregarius.

PLATE LXXIII, FIGS. 1-6; AND PLATE LXXIV, FIGS. 1-4.

Microdon gregaria, Hall. Prelim. Notice Lamellibranchiata, 2, p. 32. 1870.
Microdon (*Microdonella*) (*Eodon*) *gregarius*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 73, figs. 1-6. 1883.

Shell small, rhomboid-ovate; length less than one-third greater than the height; basal margin regularly curving, sometimes nearly straight toward the post-basal angle; posterior margin obliquely sub-truncate, slightly curving; cardinal margin gently arcuate or nearly straight. Anterior end declining abruptly from the beaks, with the extremity narrow and abruptly rounded.

Valves depressed-convex, more convex at the umbo and on the umbonal ridge.

Beaks situated at less than the anterior third of the length, small, low, closely appressed, scarcely rising above the hinge-line. Umbonal ridge distinct, but not strongly defined, continuing to the post-basal angle.

Test thin, marked by fine, concentric striæ, which are somewhat fasciculate on the anterior portion of the shell.

Anterior muscular impression not strongly developed, placed just within the anterior border of the shell.

Three specimens measure respectively 29, 27 and 22 mm. in length, and 22, 20 and 16 mm. in height.

This shell, in its general form, resembles *M. bellistriatus*, but the posterior end is always more curving, and the margin more distinctly directed forward, the post-cardinal slope narrower, and the striæ are always finer and less regular. As compared with *M. tenuistriatus* it is usually a little larger proportionally; the hinge-line is shorter, the beak situated a little nearer the anterior end and more obtuse.

Formation and localities. In the flaggy layers of the upper part of the Hamilton group, at Jefferson, Schoharie county; in shaly sandstones of the same group, between Jefferson and Summit; and in the lower part of the Chemung group, at Cortland, Ithaca, Elmira and Portville, N. Y.; and Tioga county, Pa.

Microdon (Cypricardella) tenuistriatus.

PLATE XLII, FIG. 16; PLATE LXXIII, FIGS. 23-30; AND PLATE LXXIV, FIGS. 20, 21.

Microdon tenuistriata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 32. 1870.
Microdon (Microdonella) (Eodon) tenuistriatus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 73, figs. 23–27, 29, 30; pl. 74, figs. 20, 21. 1883.

Shell large, quadrangularly sub-ovate; length one-fourth greater than the height; basal margin regularly curving; posterior margin sub-truncate, from oblique to nearly vertical and gently curving. Cardinal line gently arcuate. Anterior end rapidly declining from the beak and abruptly rounded below.

Valves depressed-convex below, rising into moderate convexity in the umbonal region.

Beaks at about the anterior third, small and appressed, rising a little above the hinge-line. Umbonal slope scarcely defined, extending in a slightly arching direction to the post-basal extremity.

Test thin, marked by fine, unequal, concentric striæ, which are at intervals raised into lamelliform undulations. In some specimens the striæ upon the umbonal region are very uniform, thread-like and equal throughout.

Anterior muscular impression large and strong, situated just within the anterior margin of the shell.

Three specimens measure respectively 46, 42 and 38 mm. in length, and 35, 31 and 29 mm. in height.

As compared with *M. bellistriatus* it is much larger than the prevailing forms of that shell, the basal line is more strongly curved, the post-umbonal slope not so well-defined, the posterior extremity usually more curved, and never angular as in that species; the striæ, except upon the umbo, are never so well-defined. In its extremely young state, its surface characters resemble *M. bellistriatus*, and the form is not essentially different, but it is less angular, and the umbonal slope less distinctly defined.

Formation and localities. In the compact arenaceous shales of the Hamilton group, at Hamilton, Madison county, and at Summit and Fultonham, Schoharie county; it also occurs in the softer calcareous shales of the group on the shores of Canandaigua lake, Ontario county, N. Y.

Microdon (Cypricardella) complanatus.

PLATE XLII, FIG. 22; AND PLATE LXXIV, FIGS. 14-19.

Microdon ? complanatus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 33. 1870.
Microdon (Microdonella) (Eodon) complanatus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 74, figs. 14-19. 1883.

Shell large, sub-rhomboid-ovate; length more than one-third greater than the height; basal margin regularly curved, sometimes straighter on the posterior portion; posterior margin obliquely truncate, slightly rounded; cardinal margin usually slightly arcuate, often appearing nearly straight. Anterior end declining somewhat rapidly from the beaks, and abruptly rounded below.

Valves moderately convex below, somewhat gibbous in the umbonal region and flattened above. The shells are sometimes so compressed that the umbonal ridge is obsolescent.

Beaks at abont the anterior fifth, small and not prominent. Umbo prominent. Umbonal ridge usually conspicuous, rounded, extending to the post-basal extremity.

Test thin, marked by fine, concentric striæ, which are fasciculate on the anterior portion of the shell.

Anterior muscular scar large and not deep, a little anterior to the beak, with a smaller accessory muscular scar above. Pallial line parallel to the basal margin, terminating in a large, shallow, posterior muscular impression. Interpallial area sometimes pitted. Hinge with an oblique fold in the right valve and a strong ligamental area.

A large specimen has a length of 72 mm., and a height of 42 mm. Three medium-sized specimens measure respectively 57, 51 and 50 mm. in length, and 34, 30 and 31 mm. in height.

This species is more elongate than *M. tenuistriatus*, and is also more convex, with a more prominent umbonal ridge and elevated beaks. Its absolute identity with the genus MICRODON has not been fully determined from the internal characters, but its external form and general features ally it more nearly with that type than with any other known genus.

Formation and localities. In the Hamilton group, at Jefferson, and between Jefferson and Summit, Schoharie county; and below Norwich, Chenango county, N. Y.

MICRODON RESERVATUS.

PLATE LXXIV, FIGS. 11-13.

Microdon reservatus, HALL. Prelim. Notice Lamellibranchiata, 2, p. 33. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 74, figs. 11-13. 1883.

SHELL above the medium size, rhomboid-ovate; length one-fourth greater than the height; basal margin regularly convex; posterior margin almost vertically truncate. Cardinal line short, arcuate. Anterior end declining somewhat abruptly from the beaks and rounded below.

Valves depressed-convex in the lower part, moderately and regularly convex above.

Beaks at about the anterior third, small, rising little above the hinge-line. Umbonal ridge scarcely defined, extending to the post-basal extremity in a slightly arching direction.

Test thin, marked by moderately strong concentric striæ, which are raised into varices or concentric undulations at irregular intervals.

Anterior muscular impression just within the anterior border, above the longitudinal center of the shell.

The three specimens figured measure respectively 45, 37 and 34 mm. in length, and 35, 28 and 27 mm. in height.

This species differs from any other described, in the stronger curvature of the basal margin, bringing the termination of the umbonal ridge higher, and giving a proportionally narrower cardinal slope and posterior end; in other respects, it is very similar to the *M. tenuistriatus* of the Hamilton group.

Formation and locality. In the Waverly sandstones of Licking county, O.

NUCULA, Lamarck. 1799.

Nucula niotica.

PLATE XLV, FIGS. 1, 2.

Nucula niotica, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 190. 1872.
" " " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, figs. 1, 2. 1883.

Shell small, obtusely sub-cuneiform; length a little greater than the height; basal margin regularly curving, rounded posteriorly; cardinal margin very oblique; anterior margin vertically truncate.

Valves very gibbous.

Beaks anterior, incurved. Umbo prominent. Umbonal slope very gibbous.

Test thick in the upper part, marked by fine, even, concentric striæ, which are aggregated into fascicles of growth.

The internal casts show strong anterior and posterior muscular impressions, and three distinct umbonal muscles; there are seven or more posterior, and five anterior teeth in a specimen of medium size.

An internal mould has a length of 17 mm., and a height of 13 mm. A specimen preserving the test has a length of 18 mm., and a height of 16 mm.

Formation and locality. In the upper beds of limestone, at the Falls of the Ohio, of the age of the Hamilton group, near Louisville, Ky.

Nucula Neda.

PLATE XLV, FIGS. 3, 4.

Nucula Neda, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 191. 1872.
" " " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, figs. 3, 4. 1883.

Shell of medium size, rhomboid-ovate, cuneate, length about one-fifth greater than the height; basal margin broadly rounded; cardinal margin sloping to the anterior and posterior extremities, which are abruptly rounded.

Valves gibbous, with the umbones ventricose.

Beaks a little more than one-third the length of the shell from the anterior end, prominent and incurved.

The surface has been marked by fine, concentric striæ.

The cast shows strong anterior and posterior muscular impressions, with three or four umbonal muscular scars and a narrow protractor scar just within the cardinal line, and anterior to the posterior muscular area, as usual in the genus.

The number of teeth cannot be determined, but there are as many as six or eight on the posterior side, with a distinct ligamental cavity, in the cast, beneath the beak.

The specimen described has a length of 21 mm., and a height of 17 mm.

This species is of the size and form of *Nucula levata*, of the lower Silurian rocks, and differs but little from *Nucula bellistriata*, of Conrad.

Formation and locality. In the hydraulic limestone of the age of the Hamilton group, near Louisville, Ky.

Nucula Randalli.

PLATE XLV, FIGS. 6-10, 16, 23, 26, 27; AND PLATE XCIII, FIGS. 1-3.

Nucula Randalli, Hall. Prelim. Notice Lamellibranchiata, 2, p. 3. 1870.
In part *Nucula Randalli*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, figs. 5-16. 1883.
Cucullea opima, Hall. Geol. Rep. Fourth Dist. N. Y., p. 197, No. 78, fig. 3, p. 196. 1843.

Shell robust, of medium size; short ovate; length about one-third greater than the height; basal margin regularly rounded, very abruptly curving at the anterior and posterior extremities; dorsal margin sloping gradually downward; anterior margin abruptly declining from the beaks.

Valves ventricose; depth of the conjoined valves equal to the height of the shell.

Beaks at about the anterior third closely incurved. Umbo very prominent. Post-umbonal slope abruptly rounded and extending nearly to the post-cardinal extremity.

Test comparatively thick, marked by fine, regular, angular thread-like striæ, which are interrupted by varices of growth, and are usually fasciculate on the anterior portion of the shell; also by extremely fine radiating striæ, which are usually more conspicuous below the middle of the valve, and which are often obscure or entirely obsolete.

Muscular impressions strongly marked. Teeth coarse.

Four characteristic specimens measure respectively 25, 23, 22 and 21 mm. in length; 17, 16, 15 and 15.5 mm. in height; and 18, 16.5, 14 and 12.5 mm. in depth.

This species presents the general form of *N. lirata*, but the beaks are broader and more closely incurved, and the surface is not marked by the strong undulations which characterize that species.*

* In the Preliminary Notice of the Lamellibranchiata, 2, page 3, the *Cucullea opima*, of the Report of the Fourth Geological District, 1843, was erroneously referred to *Nucula lirata* of Conrad. I have recently examined the original specimen of the *Cucullea opima*, and there can be no hesitation regarding its identity with *N. Randalli*, of 1870; but since the latter has gone into the literature of the science, I have preferred to leave the name as it stands at the head of this description.

In nearly all the well-preserved specimens of this species the beaks have been eroded during life, as shown in figures on plate xciii.

Formation and localities. In the shales of the Hamilton group, at Pratt's falls and Delphi, Onondaga county; in Schoharie, Otsego and Madison counties, and on the shores of Seneca lake.

Nucula lirata.

PLATE XLV, FIGS. 5, 11, 15, 17–22, 24, 25; AND PLATE XCIII, FIG. 5.

Nuculites lirata, Conrad. Jour. Acad. Nat. Sci. Phila., vol. viii, p. 250, pl. 15, fig. 7. 1842.
Nucula lineata? (Phillips), Hall. Geol. Surv. N. Y., Rep Fourth Dist., p. 197, No. 78, fig. 5, p. 196. 1843.
Nucula lirata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 3. 1870.
" " " " Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 45, figs. 17–27. 1883.
Not *Nucula lineata* (Phillips). Palæozoic Fossils, p. 39, pl. 18, fig. 64. 1841.

Shell of medium size, ovate-triangular; length from one-third to one-fourth greater than the height; basal margin regularly curving, more abruptly rounded at the posterior extremity; cardinal margin slightly arcuate, gradually sloping toward the posterior. Anterior end short, sub-truncate, usually abruptly rounded.

Valves very gibbous, ventricose in the umbonal region.

Beaks, at the anterior third or fourth of the length of the shell, distant, elevated, rising considerably above the hinge-line. Umbo very prominent. Umbonal slope elevated and rounded, merging into the general convexity before reaching the posterior end.

Test thick, marked by regular, strong, sub-angular concentric undulations, which are crossed by extremely fine radiating striæ. In older shells the margins are marked by fine, concentric striæ, the strong undulations having become obsolete.

The characters of the interior are strongly marked, as shown in figs. 24, 25, plate xlv.

A specimen preserving both valves in contact has a length of 21 mm., height 14.5 mm., and depth of both valves 12 mm. Three separate valves measure respectively 22, 20 and 18 mm. in length, and 17, 15.5 and 12 mm. in height.

This species is readily distinguished from any of the associated species by the strongly lirate surface. It differs also from *N. Randalli* in its surface striæ, lesser gibbosity and more distant beaks.

Formation and localities. In the shales of the Hamilton group, on the shores of Skaneateles, Cayuga and Seneca lakes, N. Y.

Nucula subelliptica.

PLATE XLV, FIG. 28.

Nucula subelliptica, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, fig. 28. 1883.

Shell large, ovate, wider behind; length about one-fourth greater than the height; basal margin regularly rounded, abruptly curving into the anterior end. Posterior end rounded. Cardinal line slightly arcuate. Anterior end short and abruptly rounded.

Valves convex, gibbous in the middle and on the umbonal region.

Beaks sub-anterior, prominent, rising above the hinge-line. Umbo gibbous. Umbonal slope rounded, becoming obsolete before reaching the post-basal extremity.

Test and surface markings not observed.

The specimen is a cast of the interior, showing strong muscular scars and the remains of very numerous and small post-cardinal teeth.

The internal mould has a length of 27 mm., and a height of 20 mm., with a depth to both valves of about 15 mm.

This species is distinguished from others of the horizon of the Hamilton group, in its regular ovate form, which is broader behind, and by its rounded umbonal slope. It somewhat resembles certain forms of *N. bellistriata*, but it is a larger shell, more elongate in outline, with more prominent beaks and more numerous hinge-teeth.

Formation and locality. In the shales of the Hamilton group, near Cumberland, Md.

Nucula bellistriata.

PLATE XLVI, FIGS. 1-9.

Nuculites bellastriata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 40. 1841.
Nucula bellastriata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 2. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 46, figs. 1-11. 1883.

Shell of medium size, broadly ovate, usually somewhat wider behind; length about one-fourth greater than the height; basal margin regularly curving. Posterior end broad and rounded. Cardinal line oblique and arcuate. Anterior end short, declining rapidly from the beaks, and abruptly rounded below.

Valves convex, gibbous on the umbo.

Beaks, at about the anterior fourth, appressed, rising above the hinge-line, directed forward. Umbonal slope rounded, extending from the beaks in an arching direction, to above the post-basal extremity.

Surface marked by fine, regular, sharp, concentric striæ, which do not appear to be aggregated into fascicles, but are sometimes interrupted, and the surface undulated by strong varices of growth.

The cast of the interior shows the strong muscular impressions and a broad, thickened hinge.

Three specimens measure respectively 21, 17 and 16 mm. in length, and 14, 13 and 12.5 mm. in height.

The distinguishing characters of this species are its broad and sub-circular form and regular concentric striæ. In some of its phases it resembles *N. varicosa*, but that species is sub-trigonal in outline, with larger incurved beaks, and the striæ are fasciculate, forming strong undulations of the surface at irregular intervals. It is less gibbous and broader than *N. Randalli*, the striæ are finer, usually without varices of growth, and the beaks more appressed and directed forward.

Formation and localities. In the shales of the Hamilton group, in Schoharie county; near Smyra, Chenango county; at numerous localities in Onondaga county, and on the shores of Seneca, Cayuga and Canandaigua lakes, N. Y.

Nucula varicosa.

PLATE XLVI, FIGS. 12-23; AND PLATE XCIII, FIG. 4.

Nucula varicosa, Hall. Prelim. Notice Lamellibranchiata, 2, p. 2. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 46, figs. 13-23. 1883.

Shell of medium size, ovate-triangular; length somewhat greater than the height; basal margin curving, more abruptly rounded posteriorly; post-cardinal margin arcuate or sub-truncate. Anterior end very short and abruptly rounded below.

Valves gibbous, ventricose in the umbonal region.

Beaks sub-anterior, prominent, incurved, arching over the hinge-line. Umbonal slope narrowly rounded, arching upward and extending from the beaks to the post-basal extremity. Post-cardinal slope narrow.

Test strong, marked by fine, irregular, concentric striæ, and by numerous varices of growth, which are closely arranged on the marginal portions of the shell.

Hinge strong, and posterior to the beaks it is marked by a narrow row of very fine transverse teeth. Other characters of the interior unknown.

Four characteristic specimens measure respectively 18, 17, 16 and 15 mm. in length, and 14, 16, 15 and 12 mm. in height.

This species is more erect and the beaks much more elevated than in *N. bellistriata;* it is higher in proportion to the length, giving a more triangular outline, while the concentric striæ are finer, with numerous strong varices of growth.

Formation and localities. In the shales of the Hamilton group, on the shores of Cayuga lake; and at Bellona, Yates county, N. Y.

Nucula corbuliformis.

PLATE XLVI, FIGS. (10, 11?), 24-34 (35, 36, 37?).

Nucula corbuliformis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 2. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 46, figs. 24-37.

Shell of medium size, or smaller, broadly triangular, sub-ovate; length about one-fourth greater than the height; basal margin broadly curving, more

abruptly rounded at the posterior extremity. Cardinal line declining from the beaks in both directions. Anterior end sloping rapidly from the beaks and rounded below; posterior end longer and more pointed.

Valves convex, gibbous in the umbonal region.

Beaks usually at about the anterior third, sometimes sub-central, short, moderately elevated, broad and slightly incurved. Umbonal slope not distinctly defined, rounded, direct, extending to the post-basal extremity.

Surface marked by very fine concentric striæ, and by irregular varices of growth, which sometimes produce strong undulations in the surface of the shell.

The post-cardinal teeth are large and strong, contrasting with the preceding species, *N. varicosa*.

Three specimens measure respectively 17, 16 and 14 mm. in length, and 12.5, 12 and 9 mm. in height.

This species is distinguished by its sub-equilateral triangular form.

Formations and localities. In the shales of the Hamilton group, on the shores of Cayuga, Seneca and Canandaigua lakes; and a single doubtful specimen from the Chemung group, of Ithaca, N. Y.

Nucula lamellata.

PLATE LI, FIGS. 18-21; PLATE XLV, FIG. 13; AND PLATE XCIII, FIG. 7.

Nucula lamellata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 51, figs. 18-21. 1883.

Shell small, elongate-ovate, truncate behind; length twice the height; basal margin broadly curving, straight, or slightly arcuate in the middle; posterior margin short, obliquely truncate. Cardinal line straight, directed somewhat upward toward the anterior. Anterior end large and regularly rounded.

Valves gibbous, with a broad flattened depression extending from the beaks to the base and sometimes slightly constricting the margin.

Beaks sub-central or posterior to the middle of the shell, incurved, rising a little above the hinge-line. Umbo gibbous. Umbonal slope obtusely sub-

angular, extending from the beak to the post-basal extremity, declining abruptly to the cardinal line.

Surface marked by strong, regular, lamellose, concentric striæ which appear to be made up of aggregations of extremely fine striæ.

Six or eight strong transverse teeth are preserved on each side of the beak.

Three specimens measure respectively 9, 8 and 7 mm. in length, and 4.5, 4, and 3.5 mm. in height.

This species is remarkable for its sub-central beaks and obliquely truncate posterior end, in which characters it differs from all others of the genus described in this volume. In its surface characters it is similar to *N. lirata* except that no radiating striæ have been observed, but the form of the shell is otherwise very different.

Formations and localities. In the shales of the Hamilton group, on the shore of Cayuga lake, and in the lower part of the Chemung group, at Ithaca, N. Y.

Nucula umbonata.

PLATE XLVII, FIGS. 51, 52.

Nucula umbonata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 51, 52. 1883.

Shell large, broadly ovate, wider in front; length somewhat greater than the height; basal margin gently curving in the middle and abruptly rounded at both extremities. Cardinal line sloping both anteriorly and posteriorly from the beaks. Anterior end very short and rounded.

Valves gibbous, rising from the basal margin to the umbo, which is the point of greatest gibbosity; sloping abruptly to the anterior and posterior cardinal margins.

Beaks at about the anterior fourth of the length, obtuse, scarcely rising above the hinge-line. Umbo very prominent and gibbous. Umbonal slope defined, rounded, extending from the beaks to the post-basal extremity.

Test and markings not preserved in the specimen described, which is a partial cast of the interior, showing the elongate vertical anterior muscular scars.

The specimen has a length of 21 mm., height 18 mm. and a depth to both valves of 14 mm.

This species is distinguished by its broadly ovate form, very prominent umbones and short anterior end.

Formation and locality. In the Chemung group, at Mansfield, Pa.

Nucula diffidens, n. sp.

PLATE XLV, FIGS. 12, 14.

In part *Nucula Randalli*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, figs. 5–16. 1883.

Shell of about medium size; narrowly ovate; length less than twice the height; basal margin less curved toward the anterior and more curved toward the posterior. Posterior extremity narrowly rounded. Cardinal line declining posteriorly. Anterior end short, and abruptly rounded below.

Valves gibbous in the middle and above.

Beaks at the anterior third, prominent. Umbonal slope obtusely subangular, merging into the general convexity of the valve before reaching the posterior margin.

Surface marked by fine concentric striæ, which are often irregularly fasciculate, especially toward the margin. Muscular impressions strongly marked. Teeth well developed.

Three specimens measure respectively 19, 17 and 16 mm. in length, and 11, 10 and 9 mm. in height.

This species resembles some of the smaller forms of *N. Randalli*, but the posterior end is wider, beaks less elevated and the umbonal slope is not so strongly defined.

Formation and localities. In the shales of the lower Chemung group at Ithaca, and in Chemung county, N. Y.

Nucula globularis, n. sp.

PLATE XCIII, FIG. 6.

Shell robust, of medium size; sub-globose; length somewhat greater than the height; basal margin regularly rounded, abruptly curving at both extrem-

ities; posterior end regularly rounded. Cardinal margin declining on both sides of the beak. Anterior end abruptly rounded below.

Valves ventricose.

Beaks at about the anterior third, rounded, incurved. Umbonal region very gibbous. Umbonal slope not defined, rounded.

Surface marked by regular, sharp, concentric striæ with a few varices of growth. Interior unknown.

A specimen has a length of 20 mm. and a height of 17 mm.

This species somewhat resembles, in outline, *N. bellistriata*, but it is more ventricose, the beaks more erect and the umbonal slope is less defined.

Formation and localities. In a conglomerate of the Chemung group, associated with *Ptychopteria Sao* and *Spirifera Verneuili*, east of Panama, N. Y., and at Warren, Pa.

Nucula Houghtoni.

PLATE XLV, FIGS. 29-31.

Nucula Houghtoni, Stevens. Am. Jour. Sci., 2d series, vol. 25, p. 262. 1858.
Nucula Iowensis, White and Whitfield. Proc. Bost. Soc. Nat. Hist., vol. 8. 1862.
" " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 45, figs. 29–31. 1883.

Shell of medium size, ovate, sub-trigonal; length more than one-fourth greater than the height; basal margin broadly curving, abruptly rounding into both extremities. Cardinal line sloping rapidly from the beaks to the anterior and posterior extremities. Anterior end short, declining rapidly from the beaks and abruptly rounded below.

Valves gibbous, ventricose in the umbonal region.

Beaks at about the anterior fourth, prominent, arching over the hinge-line. Umbo prominent. Umbonal slope defined, rounded, extending from the beak to the posterior extremity of the shell.

Test strong, marked by very fine concentric striæ which are scarcely fasciculate on the body of the shell.

There are about ten strong teeth posterior to the cartilage pit, and five anterior ones. Muscular scars strongly impressed.

The three specimens figured are of about the same dimensions, having a length of 17 mm. and a height of 13 mm.

This species resembles *N. Randalli*, but is a shorter form, broader posteriorly, and with a more arcuate cardinal line. It has been referred to TELLINOMYA by some authors, but in the specimens described (see fig. 31) there is a distinct cartilage pit beneath the beaks, which character does not belong to TELLINOMYA or PALÆONEILO. A comparison of the specimens figured with the type of the species shows their identity.

Formation and localities. In the sandstones of the Waverly group, at Newark and Richfield, O., and near Hillsdale, and at Battle Creek, Mich.

NUCULITES, CONRAD. 1841.

NUCULITES OBLONGATUS.

PLATE XLVII, FIGS. 1-12.

Nuculites oblongata, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 50, plate, fig. 8. 1841.
" " " HALL. Prelim. Notice Lamellibranchiata, 2, p. 4. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 1-12. 1883.
Nucula? oblonga, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., pp. 196-7. 1843.

SHELL somewhat larger than the prevailing forms belonging to this group, elongate-ovate, widest at the anterior end; length usually more than twice the height; basal margin nearly straight, sometimes gently arcuate; posterior extremity narrow and abruptly rounded. Cardinal line slightly oblique, gently arcuate; just anterior to the beaks a small portion of the hinge is bent abruptly downward, reaching to the anterior muscular scar. Anterior end short and rounded, defined in the cast by the vertical clavicle.

Valves depressed-convex in the lower and posterior portions, more convex on the anterior end and in the umbonal region.

Beaks at about the anterior fourth, appressed, not rising above the hinge-line. Umbonal slope broadly rounded and undefined, extending to the post-inferior extremity.

Test thick in the upper part of the shell. Surface marked by very fine

concentric striæ of growth, which are sometimes scarcely fasciculate on the lower portion of the shell.

Hinge furnished with numerous transverse teeth, as represented in figs. 7–9, plate xlvii.

There is a strong vertical clavicular ridge just anterior to the beaks which extends for more than half the height of the shell. Anterior muscular scar sub-circular, distinct, situated within the cavity of the anterior end. Posterior scar narrow-ovate, very close to the post-cardinal margin. Umbo marked by three or four strong muscular pits. Pallial line distinct, distant from the margin of the valve.

Four specimens measure respectively 35, 33, 26 and 24 mm. in length and 20, 15, 12 and 11 mm. in height.

This species more nearly resembles *N. cuneiformis* than any other, but is readily distinguished by its shorter anterior end, wider post-cardinal slope and rounded umbonal ridge. It also resembles *Nucula* [*Nuculites*] *ovata*, Sowerby, as identified by Phillips, but is somewhat more elongate in form, with the post-cardinal line less oblique.

Formation and localities. In the shales of the Hamilton group, in Schoharie and Otsego counties; on the shores of Skaneateles, Cayuga, Seneca and Canandaigua lakes, and numerous localities in Western New York; also in the same horizon at Patterson's creek, Va.

Nuculites cuneiformis.

PLATE XLVII, FIGS. 13-16.

Nuculites cuneiformis. Conrad. Geol. Surv N. Y., Ann. Rep., p. 50, plate, fig. 7. 1841.
" " " Hall. Prelim. Notice Lamellibranchiata, 2, p. 4. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 13–16. 1883.

Shell of medium size, elongate-ovate, cuneiform, widest in front and pointed behind; length usually more than twice the height; basal margin gently curving in the anterior part, becoming nearly straight behind, and abruptly rounded into both extremities. Posterior extremity narrow, pointed, obliquely

truncate. Cardinal line nearly straight. Anterior end sloping rapidly in a straight line from the beaks, and abruptly rounded below.

Valves depressed-convex below, becoming convex and sometimes gibbous in the umbonal region.

Beaks at about the anterior fourth, slightly incurved and rising above the hinge. Umbonal ridge angular, extending from the beak to the posterior extremity; post-cardinal slope abrupt.

Test marked by fine concentric striæ which are sometimes fasciculate on the lower portions of the shell.

Internal characters similar to those of the preceding species.

Two specimens measure respectively 32 and 29 mm. in length and 15 and 14 mm. in height.

This species is distinguished by its elongate cuneate form. It appears to be a rare species, as but few specimens have been observed among extensive collections from the localities where it occurs.

Formation and localities. In the shaly sandstones of the Hamilton group, at Jefferson and Fultonham, Schoharie county; and Oneonta, Otsego county, N. Y.

Nuculites triqueter.

PLATE XLVII, FIGS. 17-28; AND PLATE XCIII, FIGS. 8-10.

Nuculites triqueter, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 50. 1841.
" " " Hall. Prelim. Notice Lamellibranchiata, 2, p. 4. 1870.
" " " " Pal N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 17–24. 1883.

Shell of medium size, or larger, trigonal, short; length from one-fourth to one-third greater than the height; basal margin regularly curving, sometimes straight on the posterior portion, abruptly rounded into both extremities; posterior margin obliquely truncate; cardinal margin arcuate. Anterior end short, rounded.

Valves convex, gibbous in the middle and above.

Beaks at the anterior third or fourth, very prominent, incurved, arching over the hinge. Umbo prominent and gibbous. Umbonal ridge distinct,

sub-angular, arching upward and extending from the beak to the post-inferior extremity. Post-cardinal slope short, descending abruptly from the angular umbonal ridge to the obliquely truncate posterior margin.

Test thin, marked by very fine concentric striæ which do not appear to have been fasciculate.

Hinge comparatively short, furnished with more than twenty small teeth, which are continued in a row under the beaks without interruption. Muscular scars faintly marked. Clavicular ridge or septum very strong, sharply defined and curved.

Three specimens of average size measure respectively 17, 16 and 12 mm. in length, and 13, 13 and 10 mm. in height, and 11, 10 and 8 mm. in the depth of both valves.

This species is somewhat similar in form to *Nucula varicosa*, but it attains a much larger size, the umbonal slope is distinctly angular, and the surface is usually smooth, or marked by very fine concentric lines, while the impression of the curved muscular ridge or clavicle just anterior to the beaks serves to distinguish the casts, in which condition the specimens are usually found.

This form presents a wide variation in size and specific characters. Some of the specimens here included under this species were originally designated as *N. Nyssa*, but larger collections have shown that they are only extreme varieties of form. That species is now limited to the original specimens from the shales in the western portion of the State, which seem to possess sufficient differences to warrant a separate specific designation.

Formations and localities. In the shales of the Hamilton group, in Onondaga county; on the shores of Otisco, Skaneateles, Cayuga and Seneca lakes, N. Y.; and at Patterson's creek, Va. Several small specimens, apparently of this species, have been found in the Marcellus shale, at Leroy and West Bloomfield, N. Y.

Nuculites Nyssa.

PLATE XLVII, FIGS. 29, 30.

Nuculites Nyssa, Hall. Prelim. Notice Lamellibranchiata, 2, p. 5. 1870.
In part " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 25–30. 1883.

Shell of medium size, broadly ovate, wider anteriorly; length about one-third greater than the height; basal margin regularly curving, abruptly rounding into both extremities; posterior margin oblique, sub-truncate above and abruptly rounded below. Cardinal line short, slightly arcuate. Anterior end short, rounded.

Valves highly convex, gibbous in the umbonal region.

Beaks at about the anterior fourth, incurved, rising a little above the hinge. Umbonal ridge prominent, extending to the post-inferior extremity. Cardinal slope abrupt.

Surface marked by fine concentric striæ, which are slightly fasciculate, producing low undulations of the surface.

Muscular scars faintly impressed. Clavicular ridge narrow, curving toward the anterior end and extending about two-thirds the height of the valve.

The two specimens described measure respectively 18 and 14 mm. in length and 12 and 10 mm. in height.

This species closely resembles *N. triqueter*, but has a more ovate form; the other comparisons are given under the description of that species.

Formation and locality. In concretionary layers in the shales of the Hamilton group, on the shore of Lake Erie.

LEDA, SCHUMACHER. 1817.

LEDA DIVERSA.

PLATE XLVII, FIGS. 31-37.

Leda (Nuculana) diversa, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 31-37. 1883.

SHELL small, ovate-cuneate; length about twice the height; basal margin curving in the anterior portion, becoming straight or nearly so, behind. Posterior extremity acuminate. Cardinal line straight, oblique. Anterior end proportionately large, declining rapidly from the beak and regularly rounded below.

Valves gibbous in the anterior and umbonal regions, attenuated behind.

Beaks at about the anterior third, prominent, incurved, rising above the hinge-line. Umbo prominent, obtuse. Umbonal ridge sub-angular, extending from the beaks to the posterior extremity; the surface sloping abruptly from this ridge to the hinge-line.

Surface marked by fine, regular, concentric striæ which are merged into the umbonal ridge and are obsolete on the cardinal slope. Interior unknown.

A specimen of the usual form has a length of 10 mm. and a height of 5 mm. A somewhat larger and shorter individual has a length of 11 mm. and a height of 6 mm.

This species differs from *L. brevirostris* in being narrower and more elongate posteriorly, with more anterior beaks, and more direct umbonal ridge.

Formation and localities. In the soft calcareous shales of the Hamilton group, at Bear's gulf and Jefferson, in Schoharie county, and in Onondaga county, N. Y.

LEDA BREVIROSTRIS.

PLATE XLVII, FIGS. 38-41.

Leda? brevirostris, HALL. Prelim. Notice Lamellibranchiata, 2, p. 6. 1870.
Leda (Nuculana) brevirostris, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 38, 39 (40, 41?). 1883.

SHELL small, ovate-triangular, abruptly nasute behind; length about one-third greater than the height; basal margin broadly curved in the anterior por-

tion, becoming straight toward the posterior. Posterior extremity abruptly acute, not attenuate. Cardinal line straight, oblique. Anterior end large, broadly rounded, comprising half the shell.

Valves convex, very gibbous in the anterior portion and in the umbonal region.

Beaks behind the anterior third, prominent, rising above the hinge-line. Umbonal ridge defined, angular, curving downward, abruptly sloping to the posterior extremity.

Surface marked by fine, even, concentric striæ, which are obsolete on the post-cardinal slope. Interior unknown.

Two specimens measure respectively 9 and 11 mm. in length, and 6 and 7 mm. in height.

This species differs from *L. rostellata* in the shorter and less curved posterior end; the anterior portion is broader and more extended; the beaks are more distant from the anterior extremity.

Formation and localities. In the shaly sandstones of the Hamilton group, from near Summit and Jefferson, Schoharie county, N. Y.

Leda rostellata.

PLATE XLVII, FIGS. 42-47.

Nuculites rostellata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 50. 1841.
Leda? rostellata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 5. 1870.
Leda (*Nuculana*) *rostellata* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 45–47. 1883.
" " *perstriata*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 42–44. 1883.

Shell small, falciform; length more than twice the height; basal margin gently curving from the posterior extremity, more rapidly curving anteriorly. Posterior end attenuate, arching upward, with the extremity narrowly rounded or sub-truncate. Cardinal line oblique, declining posteriorly, and regularly curved. Anterior end comparatively short, abruptly rounded.

Valves convex, somewhat gibbous in the umbonal region, depressed-convex posteriorly.

Beaks between the anterior third and fourth of the length of the shell, prominent, rising above the hinge-line. Umbonal ridge distinctly defined, sharply angular above, becoming truncate below in its extension to the posterior extremity.

Surface marked by fine, regular, equal, sharp concentric striæ, which converge upon the posterior end of the shell, cross the umbonal angle, and are obsolescent on the post-cardinal slope.

Hinge crenulated with minute teeth which extend half the distance from the beak to the posterior end.

Three specimens measure respectively 16, 13 and 10 mm. in length, and 6.5, 6, and 4.5 mm. in height.

This species differs from *L. diversa* in its more elongate form, in the more recurved and falcate posterior extremity, proportionally more anterior beaks, finer and more regular striæ, which do not become confluent on the umbonal ridge.

Some of the specimens are marked by extremely fine striæ, which are scarcely visible except under a magnifier. This character, and their somewhat shorter form, led to their separation under the name of *L. perstriata*, but the distinction is found not to be tenable, as in some specimens the striæ are extremely fine in the upper part of the shell, and have the characteristic appearance of typical specimens of *L. rostellata* in the lower part. The older individuals are more extremely attenuate behind than the younger specimens.

Formation and localities. In the shales of the Hamilton group, on the shores of Skaneateles, Owasco and Seneca lakes, and at Pratt's falls, Onondaga county, N. Y.

LEDA OBSCURA, n. sp.

PLATE XLVII, FIG. 48.

Leda (Nuculana) curta, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, fig. 48. 1883.
Not *Leda curta*, MEEK. Proc. Acad. Nat. Sci. Phila. 1861.

SHELL small, ovate-triangular, acute at the posterior extremity; length one-third greater than the height. Gibbous in the umbonal region, and regularly convex below, with a slight depression at the base toward the posterior end.

Beak between the middle and anterior third. Umbonal ridge not defined.

Surface marked by fine, sharp, regular, concentric striæ.

The specimen described has a length of 6.5 mm. and a height of 4.5 mm.

A single specimen only has been observed. It possesses the general form and surface characters of LEDA with some indications of its relations with PALÆONEILO in its depressed post-basal margin.

Formation and locality. In the arenaceous shales of the Hamilton group, at Fultonham, Schoharie county, N. Y.

LEDA PANDORIFORMIS.

PLATE XLVII, FIGS. 49, 50.

Leda pandoriformis, STEVENS. Am. Jour. Sci., 2d ser., vol. 25, p. 262. 1858.
Leda (Nuculana) Ohioensis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 49, 50. 1883.

SHELL large, elongate-ovate, sub-cuneate; length more than twice the height; basal margin regularly curving in the middle and posteriorly, more abruptly toward the anterior end. Posterior extremity attenuate, abruptly rounded or sub-truncate. Cardinal line oblique, declining from the beak, and slightly curving upward. Anterior end, in the cast, obliquely sub-truncate above, and regularly rounded below.

Valves moderately convex, scarcely gibbous in the umbonal region, depressed-convex or somewhat flattened along the posterior half.

Beaks at about the anterior third, rising above the hinge-line. Umbonal ridge obtusely angular, extending to the posterior extremity.

Surface characters unknown.

Hinge marked both anteriorly and posteriorly by a row of slender teeth, with a sub-rostral ligamental pit, which is imperfectly represented in the figure.

The specimen described has a length of 26 mm. and a height of 12 mm.

This species is larger than any other form here described, with a broader posterior end. It has somewhat the shape of *L. diversa*, but is less gibbous in the anterior portion and less abruptly attenuate behind.

Formation and locality. In the Waverly sandstone of Newark, O., and at Battle Creek, Mich.

PALÆONEILO, Hall. 1870.

Palæoneilo constricta.

PLATE XLVIII, FIGS. 1-16; AND PLATE LI, FIG. 17.

Nuculites constricta, Conrad. Jour. Acad. Nat. Sci. Phila., vol. viii, p. 249. Pl. 15, fig. 8. 1842.
Nucula bellatula, Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 197, t. 78, fig. 7. 1843.
Palæoneilo constricta (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 7. 1870.
" " " " Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 48, figs. 1-15. 1883.

Shell of medium size or smaller; ovate-cuneate, sub-nasute behind; proportions of length and breadth extremely variable, the length usually about one-third greater than the height; basal margin rounded in the middle and anterior portions, straight or slightly constricted toward the posterior end. Posterior extremity narrowed, cuneate or sub-nasute, constricted below. Cardinal line abruptly declining anterior to the beak, and more gently declining to the posterior. Anterior end abruptly rounded.

Valves convex below and posteriorly, becoming gibbous above the middle and in the umbonal region.

Beaks at about the anterior third, prominent, rising above the hinge-line. Umbonal ridge rounded, not strongly defined, with a depression or undefined furrow below it, which extends from just posterior to the beak to the post-inferior margin.

Surface, in well-preserved specimens, marked by fine, regular and even, thread-like striæ, which frequently become obsolescent in the furrow and on the post-cardinal slope.

Anterior and posterior muscular impressions strongly marked, and with umbonal muscular scars. Hinge marked by numerous crenulations, which are coarser toward the anterior and posterior extremities.

Three specimens measure respectively 20, 20 and 25 mm. in length, and 14, 12 and 18 mm. in height. Two extreme examples have respective lengths of 23 and 16 mm. and heights of 13 and 13 mm.

This species is of about the size of *Nucula bellistriata*, and striated in the same manner, but is readily distinguished by its form and constricted posterior end.

It is proportionally much higher than *P. plana* and smaller and more constricted than *P. maxima.*

Formations and localities. In the shales of the Hamilton group, Fultonham and Bear's gulf, Schoharie county; shores of Seneca and Cayuga lakes, N. Y., and Patterson's creek, Va.; in the Portage group, at Portland Harbor, Chautauqua county, and in the lower Chemung or Ithaca group, at Ithaca, N. Y.

PALÆONEILO CONSTRICTA, var. FLEXUOSA.

PLATE XLVIII, FIGS. 17-20.

Palæoneilo constricta (CONRAD *sp.*), *var. flexuosa*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 48, figs. 16-20 (16 in error). 1883.

Specimens having the general aspect of *P. constricta* occur in the Chemung group, at Ithaca. The shell is stronger, more elongate in form, more coarsely and irregularly striated with the constriction at the posterior end strongly marked.

Formation and locality. In the lower part of the Chemung group, at Ithaca, N. Y.

PALÆONEILO PLANA.

PLATE XLVIII, FIGS. 21-28.

Palæoneilo plana, HALL. Prelim. Notice Lamellibranchiata, 2, p. 7. 1870.
" " " Pal. N. Y., vol. 5, pt. 1. Plates and Explanations: Pl. 48, figs. 21-28. 1883.

SHELL below the medium size, transversely elliptical, compressed, elongate and somewhat pointed behind; length almost twice the height; basal margin regularly and gently rounded, with a slight and undefined constriction near the posterior end. Posterior extremity acutely rounded. Cardinal line declining on each side of the beak. Anterior end regularly rounded.

Valves depressed-convex.

Beaks anterior to the centre, small, rising but little above the hinge-line. Umbonal slope not defined, obscurely indicated by an undefined depression, which scarcely constricts the margin.

Surface marked by very fine concentric striæ, which are often obscure or obsolete. Interior as shown in figs. 25, 26 of plate xlviii.

Several specimens have a length of 15 mm. and a height of 8 mm.

This shell is delicate in texture, smaller, more elongate, and with beaks more nearly central than *P. constricta.*

Formations and localities. In the shales of the Hamilton group, in Otsego county, on the shores of Cayuga, Seneca and Canandaigua lakes; and in the lower beds of the Chemung group, at Ithaca, N. Y.

PALÆONEILO MAXIMA.

PLATE XLVIII, FIGS. 29-38.

Nuculites maxima, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 50. 1841.
Tellina? ovata, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 196, fig. 6. 1843.
Palæoneilo maxima (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 9. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 48, figs. 29-38. 1883.

SHELL large, ovate-acute; length one-half greater than the height; basal margin very convex in the middle, curving regularly to the anterior end, and more nearly straight behind. Posterior extremity narrow and abruptly rounded, or sub-truncate at the termination. Cardinal line declining rapidly on either side of the beak. Anterior end somewhat narrowly rounded.

Valves regularly convex below, becoming gibbous in the middle and above.

Beaks anterior to the centre, prominent, small, with the apices very slightly incurved. Umbonal ridge distinct, sub-angular, extending to the upper side of the posterior extremity; the furrow below is broad, obscure and undefined.

Surface marked by fine concentric striæ, which are often very obscure or obsolescent. Muscular scars unknown. Hinge-line crenulate, but not properly represented in figs. 37 and 38 of plate xlviii.

Three specimens measure respectively 31, 32.5 and 35 mm. in length, and 17, 19 and 20 mm. in height.

This species differs from all the preceding in its more gibbous form and abruptly contracted posterior end, approached only by some of the elongate forms of *P. constricta.* Its internal characters are obscure.

Formation and localities. In the shales of the Hamilton group, at Summit and Fultonham, Schoharie county, and on the shores of Cayuga lake, N. Y.

Palæoneilo tenuistriata.

PLATE XLIX, FIGS. 1-12, 14; AND PLATE XCIII, FIG. 13.

Palæoneilo tenuistriata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 9. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 49, figs. 1–12. 1883.

Shell large, ovate-elliptical; length more than one-third greater than the height; basal margin regularly curving. Posterior end doubly truncate. Cardinal line gently arcuate. Anterior end short, rounded.

Valves convex, gibbous above the middle and in the umbonal region.

Beaks at about the anterior third, moderately prominent, nearly straight, little elevated above the hinge-line. The posterior end of the shell is depressed-convex, with a more or less distinct depression extending to the post-inferior extremity from just posterior to the beaks, giving a truncation and slight constriction of the margin.

Test thick, especially in the dorsal region. Surface marked by very fine concentric striæ, which are often crowded together on the basal and posterior portions of the shell, forming irregular undulations of growth. In some well-preserved specimens the concentric striæ are elevated into sharp lamellæ.

Three specimens measure respectively 29, 33 and 37 mm. in length, and 18, 19 and 20 mm. in height.

This species may be distinguished from *P. fecunda* by its finer and more irregular surface striæ and usually shorter form.

Formation and localities. In the soft shales of the Hamilton group, on the shores of Skaneateles, Cayuga and Seneca lakes; at Pratt's falls and Delphi, Onondaga county, and York and Moscow, Livingston county, N. Y.; also from Patterson's creek, Va.

Palæoneilo fecunda.

PLATE XLIX, FIGS. 13, 15-24.

Palæoneilo fecunda, Hall. Prelim. Notice Lamellibranchiata, 2, p. 8. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 49, figs. 13–24. 1883.

Shell large, elongate-ovate; length nearly twice the height; basal margin broadly curving. Posterior end obtusely rounded or doubly truncate. Cardinal line arcuate. Anterior end regularly rounded.

Valves regularly convex below, gibbous above and in the umbonal region.

Beaks at less than the anterior third from the end, moderately elevated above the hinge-line. Umbonal slope flattened, giving a slight angularity to the shell above and below it, and an oblique truncation to the posterior extremity.

Test thick, marked in the anterior portion by fine, regular concentric striæ, some of which become elevated into sharp, lamelliform striæ, with finer intermediate ones on the posterior half of the shell. The characters of the interior are well shown in figs. 19, 20, 21 and 22 of plate xlix.

Three specimens measure respectively 35, 38 and 43 mm. in length, and 18, 21 and 24 mm. in height.

This species differs little in size and form from *P. muta*, but is distinguished by the fine striæ on the anterior portion of the shell, and the finer and more subdued character of the lamellose striæ on the posterior part.

Formation and localities. In the soft shales of the Hamilton group, on the shores of Cayuga, Seneca and Canandaigua lakes; at Darien, in Genesee county, at York and Moscow, in Livingston county, N. Y.; also in Hardy county, Va.

Palæoneilo muta.

PLATE XLIX, FIGS. 25-32.

Palæoneilo muta, Hall. Prelim. Notice Lamellibranchiata, 2, p. 8. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 49, figs. 25-32.

Shell large, elongate-ovate; length less than twice the height. General form and convexity similar to the preceding.

Entire surface marked by regular, strong, lamellose elevated striæ, with very fine, intermediate striæ.

Three specimens measure respectively 43, 41 and 35 mm. in length, and 24, 21 and 20 mm. in height.

This species has the form and proportions of *P. fecunda*, differing principally in the character of the surface, which is entirely covered by strong, lamellose

striæ, while in that species the same character of surface affects only the posterior half of the shell.

In form and proportions, the three species, *P. tenuistriata*, *P. fecunda* and *P. muta*, are very similar, and might be included under one specific designation, except for the wide and characteristic differences in the surface ornamentation, which are constant even among specimens from the same locality.

Formation and localities. In the soft shales of the Hamilton group, on the shores of Skaneateles, Seneca and Canandaigua lakes; at North Bristol, in Ontario county; at Bellona, Yates county, and other localities in Western N. Y. It likewise occurs in the same formation in Hardy county, Va.

PALÆONEILO EMARGINATA.

PLATE L, FIGS. 1-11.

Nuculites emarginata, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 50. 1841.
Palæoneilo emarginata (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 7. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 1-12. 1883.

SHELL of medium size or larger, sub-elliptical; length usually more than twice the height; basal margin gently curving or nearly straight from the post-inferior angle to the anterior end, where it is more abruptly rounded; posterior margin deeply sinuate. Cardinal line gently arcuate. Anterior end regularly and somewhat abruptly rounded.

Valves regularly convex in the lower anterior half, becoming gibbous above.

Beaks at a little less than the anterior third from the end, and, except in the shorter forms, moderately prominent. Umbonal slope marked by a strong elevation or ridge, with a depression above it, which produces a marked emargination. The post-cardinal extremity, above this, is produced into a linguiform extension, which is sometimes angular, but usually abruptly rounded at the termination.

Surface marked by strong, elevated, distant, lamellose, concentric ridges, extending the entire length of the shell, between which are very fine con-

centric striæ. The intermediate striæ become obscure or obsolete, according to the degree of weathering and nature of the matrix.

Five specimens measure respectively 22, 24, 26, 27, 28 and 40 mm. in length, and 12, 13.5, 16, 12 and 16 mm. in height.

This species is distinguished by its regular, strong, lamelliform, concentric striæ, and deeply emarginate, post-inferior extremity.

Formations and localities. In the arenaceous layers of the Hamilton group, at Jefferson, Summit and Fultonham, Schoharie county; in the soft shales on the shores of Skaneateles, Cayuga, Seneca and Canandaigua lakes, and at other localities in Western N. Y.; also in beds of the same age near Cumberland, Md. It likewise occurs in the lower beds of the Chemung group, at Ithaca, N. Y.

Palæoneilo perplana.

PLATE L, FIGS. 15-22; AND PLATE XCIII, FIG. 12.

Palæoneilo ? perplana, Hall. Prelim. Notice Lamellibranchiata, 2, p. 12. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 15-22. 1883.

Shell large, ovate, sub-cuneate; length less than twice the height; basal margin gently curving, sometimes a little flattened or slightly sinuate in the posterior portion; post-inferior margin doubly truncate. Cardinal line gently arcuate. Anterior end broadly and regularly rounded.

Valves convex in the lower part of the anterior half, gibbous above and in the umbonal region.

Beaks usually at about the anterior third, sometimes just anterior to the centre, broad, prominent, rising but little above the hinge-line, gently incurved. Umbonal slope marked by two broad ridges, separated by a broad, undefined sulcus, producing sinuations in the post-inferior and post-cardinal margins; the shell, at the termination of the upper ridge, and sometimes between the two ridges, is produced into a short, linguiform extension. Post-cardinal slope flattened or concave.

Entire surface marked by extremely fine, crowded striæ, and at intervals by strong, elevated lamellæ, which are usually obsolete, except on the posterior portion of the shell.

The central portion of the hinge-line is marked by fine crenulations (those of the extreme anterior and posterior are not determined). The post-cardinal margin shows two longitudinal folds above the crenulated hinge.

Three specimens measure respectively 43, 38 and 34 mm. in length, and 25, 21 and 20 mm. in height.

This species, in its general form, bears some resemblance to *P. fecunda* and *P. muta*, but the umbonal ridge is less defined, the posterior extremity is more extended, and the lamellose striæ are more distant. The surface is usually smooth or polished, and the striæ scarcely visible to the naked eye.

The larger proportion of the specimens are from the softer shales, and extremely compressed, while others, in different conditions of preservation, show the anterior half of the shell to be gibbous. The first specimens described were from the soft shales, and gave origin to the name *P. perplana.*

Formation and localities. In the shales of the Hamilton group, at Fultonham, and near Summit, Schoharie county; near Clarksville, Albany county; on the shores of Seneca and Cayuga lakes; and in the town of Bristol, Ontario county, N. Y.

Palæoneilo Virginica, n. sp.

PLATE XCIII, FIG. 14.

Shell large, robust, elliptical; length less than twice the height; basal margin gently curving; posterior extremity doubly truncate. Cardinal line long, gently arcuate. Anterior end large, regularly rounded at the extremity.

Valves regularly convex in the lower and posterior portions, becoming gibbous in the middle and umbonal regions.

Beaks at the anterior third, low, little elevated above the hinge-line. Umbonal slope convex, not conspicuously defined in the cast, marked by two low, rounded, diverging ridges, extending to the post-inferior extremity and to the middle of the posterior end, forming a short, linguiform extension. Post-cardinal slope slightly concave.

Surface marked by fine concentric striæ which are fasciculate, forming undulations on the posterior portion of the shell. The cardinal line, in the

specimen, is partially exposed, showing the characteristic crenulations of the hinge.

The specimen described has a length of 51 mm. and a height of 30 mm.

The nearest relation of this form is with *P. perplana*, but it is a much larger shell and its general form more distinctly elliptical. The surface markings on the posterior part of the shell are precisely similar to that species, but the specimen described is a cast, and an exact comparison cannot be drawn.

Formation and locality. In the Hamilton group, at Patterson's creek, Va.

Palæoneilo arata.

PLATE L, FIG. 23.

Palæoneilo arata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, fig. 23. 1883.

Shell of medium size, sub-elliptical; length about twice the height; basal margin convex in the anterior half, concave posteriorly, and rather abruptly recurving. Posterior extremity somewhat prolonged and abruptly rounded. Cardinal line nearly straight or slightly arcuate. Anterior end regularly rounded.

Valves moderately convex, gibbous in the umbonal region.

Beaks between the anterior third and fourth, not prominent. Umbonal slope convex, without defined ridge, merging in the general convexity before reaching the posterior extremity. Post-cardinal slope concave, constricting the margin of the shell.

Surface marked by extremely fine concentric striæ, which are often obscure or obsolete, and by distant, strong, elevated, lamellose ridges. Interior unknown.

The specimen described has a length of 30 mm. and a height of 16.5 mm.

This species somewhat resembles *P. tenuistriata* and *P. fecunda*, but there is an entire absence of an umbonal ridge, or interruption in the curvature of the posterior part of the shell, and the lamelliform ridges are stronger and more distant.

Formation and locality. In the shales of the Hamilton group, near Norwich, Chenango county, N. Y.

Palæoneilo brevis.

PLATE L, FIGS. 24-33.

Palæoneilo brevis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 10. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 24–33. 1883.

Shell small, ovate, or ovate-sub-triangular; length about one-third greater than the height; basal margin gently curving, with a slight constriction toward the posterior extremity. Cardinal line arcuate. Anterior end usually short and regularly rounded.

Valves convex below, gibbous in the middle and on the umbonal ridge.

Beaks usually at about the anterior third or a little posterior thereto, prominent, moderately elevated above the hinge-line. Umbonal slope marked by a slight flattening of the shell, which produces a gentle constriction in the post-inferior margin. This depression is rarely margined on each side by an undefined elevation.

Surface marked by fine, even, concentric striæ; the casts exhibiting only the stronger elevations which give an irregular appearance to the concentric striæ. Anterior muscular impression very strongly marked. Posterior scar large and shallow. Hinge marked by numerous minute crenulations.

Three specimens of this species measure respectively 21, 20 and 14 mm. in length, and 14, 12 and 10 mm. in height.

This species is allied to *P. constricta*, but is more gibbous, less curved along the basal margin, and the constriction of the posterior end is so slight as to be scarcely detected in most individuals.

Formation and localities. In some shaly calcareous sandstones of the Chemung group, at Franklin, Delaware county; in arenaceous shales, at Philipsburgh, Alleghany county, N. Y., and at Lawrenceville, Tioga county, Pa.

Palæoneilo filosa.

PLATE XLIX, FIGS. 33-38.

Nuculites filosa, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 250, pl. 15. fig. 7. 1842.
Palæoneilo filosa (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 10. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 49, figs. 33–38. 1883.

Shell below the medium size, elongate-ovate, or ovate-sub-cuneate in its shorter varieties; length about twice the height in the prevailing forms. Basal margin gently curving. Posterior extremity obliquely sub-truncate. Cardinal line arcuate; anterior end regularly rounded.

Valves depressed-convex in the lower part, becoming convex and somewhat gibbous in the middle and in the umbonal region.

Beaks at about the anterior third, rising but little above the hinge-line. Umbonal slope somewhat flattened.

Surface marked, on the anterior half, by fine concentric striæ, which pass into sharp, elevated, lamellose striæ on the posterior half. Interior shown in figs. 36, 37 and 38 of plate xlix.

Three specimens measure respectively 30, 25 and 23.5 mm. in length, and 15, 13 and 14 mm. in height.

This species is closely allied to *P. fecunda*, of the Hamilton group, but is readily distinguished by having the posterior extremity prolonged at the cardinal line, giving the greatest length at this point, while in that species the greatest length of the shell is usually considerably below the cardinal line. The shell is also smaller, seldom attaining much more than half the length of *P. fecunda*.

The prevailing forms, at the original localities, are proportionally longer than that figured by Mr. Conrad, but there are among them forms of similar proportions as in figs. 37 and 38. There being no other similar species known at these localities, there can be no doubt of the propriety of this reference.

Formation and localities. In the lower part of the Chemung group, at Ithaca and Cortland, N. Y.

Palæoneilo angusta, n. sp.

PLATE XCIII, FIG. 11.

Shell below the medium size, elongate, sub-elliptical; length about twice the height; basal margin regularly curving. Posterior extremity produced, obliquely sub-truncate and doubly emarginate. Cardinal line straight and long. Anterior end comparatively large and broadly rounded.

Valves very moderately convex below, scarcely gibbous in the middle and above.

Beaks at about the anterior third, low, closely appressed, rising but little above the hinge-line. Umbonal slope defined, sub-angular, extending to the post-inferior extremity. Post-cardinal slope broad, and marked longitudinally by a distinct angular fold reaching to the posterior margin.

Surface marked by fine concentric striæ; and on the upper anterior portion, the umbo and post-cardinal slope, by regular somewhat distant lamellose elevations.

Two specimens measure respectively 20 and 26 mm. in length, and 10 and 13 mm. in height.

In its elongate form it bears some resemblance to *P. muta*, but the post-cardinal slope is narrower, the ridge along this slope is stronger and more nearly central and the posterior extremity is doubly sinuate.

Formation and locality. In the Chemung group, near Elmira, N. Y.

Palæoneilo bisulcata.

PLATE L, FIGS. 12-14.

Palaeoneilo bisulcata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 10. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 13, 14. 1883.

Shell small, broadly sub-ovate; length nearly one-half greater than the height; basal margin regularly curving to the post-inferior extremity. Posterior margin sinuate, obliquely sub-truncate. Cardinal line arcuate. Anterior end regularly rounded.

Valves moderately convex, slightly gibbous in the umbonal region.

Beaks small, situated a little more than one-third the length from the anterior end. Umbonal slope marked by two distinct furrows, which are limited by three rather sharply angular carinæ, one very near the cardinal line, one along the umbonal angle, and another one intermediate and equidistant.

Surface marked by coarse, regular, elevated, concentric folds which are strongly undulated as they cross the ridges and depressions of the posterior slope.

A specimen of normal form has a length of 14 mm. and a height of 8 mm.

This is a comparatively rare form, and is most nearly allied to *P. emarginata*, but differs in the characters of the posterior slope; that species having a single very deep sulcus, while this one has two shallower sulci, the upper one extending nearly to the cardinal line.

Formation and locality. In the Chemung group, near Elmira, N. Y.

Palæoneilo elongata.

PLATE XLVIII, FIG. 39; AND PLATE XCIII, FIG. 11 a.

Palæoneilo elongata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 48, fig. 39. 1883.

Shell small, very elongate-ovate, attenuate posteriorly; length twice the height; basal margin regularly and gently convex, curving abruptly upward at the anterior end. Posterior extremity abruptly rounded or sub-truncate. Cardinal margin arcuate, anterior end regularly rounded.

Valves depressed-convex below and posteriorly, more convex above the middle in the anterior and umbonal regions.

Beaks situated behind the anterior third, small, not prominent. Umbonal ridge undefined.

Surface marked by very fine, even, slightly undulating concentric striæ. Interior unknown.

Three specimens measure respectively 16, 14 and 13 mm. in length, and 7, 7 and 6.5 mm. in height.

This species resembles *P. attenuata*, but shows no constriction of the basal margin, and the beaks are more nearly central.

Formation and localities. In the shales of the Chemung group, at Philipsburgh, Alleghany county, N. Y., and at Warren, Pa.

Palæoneilo attenuata.

PLATE L, FIGS. 34-39.

Palæoneilo attenuata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 12. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 34–39. 1883.

Shell above the medium size, ovate-lanceolate in outline; length twice the height; basal margin gently curved in the anterior and posterior portions, and sinuate a little behind the middle. Posterior extremity narrowly rounded. Cardinal line gently arcuate, declining posteriorly. Anterior end regularly rounded.

Valves in the posterior part, depressed-convex, with a shallow depression in the middle; the anterior portion is more convex, becoming gibbous in the middle and above.

Beaks a little in advance of the anterior third, small, little elevated above the hinge. Umbonal slope rounded, scarcely defined.

Test thin, marked by fine, closely-arranged striæ of growth, with stronger fascicles, at irregular intervals, which remain, in some degree, impressed upon the cast.

The characters of the interior are shown in figs. 35 and 36 of plate l.

Three specimens measure respectively 20, 31 and 42 mm. in length, and 10, 15 and 19 mm. in height.

This species is readily distinguished by the elongate form, depressed-convex valves, and absence of the umbonal ridge and furrow. The only species with which it can be compared is *P. elongata* of the Chemung group.

Formation and localities. In the Waverly sandstone, at Granville and Newark, Licking county, O.

Palæoneilo truncata.

PLATE L, FIGS. 40, 41.

Palæoneilo truncata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 40, 41. 1883.

Shell of medium size, trapezoidal; length about twice the height; basal margin nearly straight or slightly concave in the middle; posterior margin retrally truncate, acutely rounded above into the cardinal line, which is very slightly arcuate. Anterior end rounded.

Valves convex below, becoming gibbous in the middle and upper part.

Beaks at about the anterior fourth, somewhat prominent, rising above the hinge-line. Umbonal ridge broad, distinct. Post-cardinal slope depressed, marked above by an undefined elevation near the hinge-line.

Test thick, marked by fine, closely-arranged, concentric striæ, which in some parts are crowded and fasciculate, but which do not rise into regular lamellar expansions. Interior unknown.

The two specimens described measure respectively 30 and 24 mm. in length, and 15 and 12 mm. in height.

This species may be compared with *P. muta*, but it is a proportionally longer shell, the basal and cardinal margins are nearly parallel, the beaks are more anterior, and the shell surface is not raised in regular lamellar expansions.

Formation and localities. In the sandstones of the Waverly group, at Richfield and Medina, O.

Palæoneilo sulcatina.

PLATE L, FIGS. 42–46.

Nuculites sulcatina, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 250, pl. 15, fig. 10. 1842.
Leda nuculiformis, Stevens. Am. Jour. Sci., series 2, vol. xxv, p. 262. 1858.
" *Barrisi*, White and Whitfield. Proc. Boston Soc. Nat. Hist., vol. viii, p. 298. 1862.
Palæoneilo Barrisi (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 11. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 50, figs. 42–46. 1883.
Nucula Hubbardi, Winchell. Proc. Acad. Nat. Sci., Phila. 1862.

Shell of medium size or larger, sub-elliptical or narrowly ovate; length nearly twice the height; basal margin regularly curving. Posterior extremity narrowly rounded, with sometimes an obscure retral truncation. Cardinal line gently arcuate. Anterior end regularly rounded.

Valves convex posteriorly and below, becoming gibbous in the middle and upper portion.

Beaks at about the anterior third, prominent, rising but little above the hinge-line. Umbonal region regularly convex. Umbonal slope convex or sometimes flattened, giving an obscure truncation to the posterior extremity. (Fig. 43 exaggerates this feature, which is more properly shown in fig. 44.)

Test thin, marked by fine, close, concentric striæ with sharp lamellose elevations at irregular intervals. The characters of the interior are shown in figs. 45 and 46 of plate l.

Three specimens measure respectively 35, 30 and 22 mm. in length, and 18, 16 and 12 mm. in height.

This species is more symmetrically ovate and gibbous than any of the preceding forms. It is easily distinguished from *P. attenuata*, with which it is associated, by its shorter and more gibbous form and absence of mesial constriction.

Its mode of occurrence at Hillsdale, Mich., is in the condition of casts, which preserve some impressions of the finer striæ, while the place of the stronger lamellæ is marked by narrow, concentric sulci, suggesting the name given by Mr. Conrad.

A comparison with the type specimens of *Leda nuculiformis*, Stevens, leaves no doubt of its identity with the species originally described by Mr. Conrad as *Nuculites sulcatina*.

Formation and localities. In the Waverly sandstone at Richfield and Newark, O.; also occurring at Battle Creek, and abundantly at Hillsdale, Mich.

Palæoneilo? dubia, n. sp.

PLATE XCIII, FIG. 15.

Shell large, elongate-ovate; length and height as five to three; basal margin regularly curving for more than the anterior half of its length, slightly sinuate to the posterior extremity, which is narrowly rounded. Anterior end short, contracted beneath the beak and rounded below.

Valves convex below, rising rather abruptly to the middle where they are gibbous or ventricose.

Beaks sub-anterior, prominent and incurved. Umbonal slope regularly rounded, and the convexity is continued to the posterior extremity. Below the umbonal slope is a broad constriction occupying one-third of the length of the shell.

Surface marked by fine concentric striæ, and on the anterior and basal portions by strong concentric undulations.

The specimen described has a length of 56 mm. and a height of 34 mm.

This form is larger than any other known species of the genus. The constriction near the posterior end is broader than in any other. Its absolute identity with Palæoneilo has not been determined.

Formation and locality. In the Corniferous limestone, at Delaware, Ohio.

MACRODON, LYCETT. 1845.

MACRODON HAMILTONIÆ.

PLATE LI, FIGS. 1-7, 9, 10.

Macrodon Hamiltoniæ. HALL. Prelim. Notice Lamellibranchiata, 2, p. 13. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 51, figs. 1–10 (fig. 8 in error). 1883.

SHELL of medium size or larger, sub-elliptical or sub-ovate, wider behind; length about twice the height; basal margin broadly curving, sometimes nearly straight in the anterior portion. Posterior extremity broadly rounded, sometimes sub-truncate in the upper half. Cardinal line essentially straight, obtusely sub-angular at both extremities. Anterior end abruptly rounded or sub-truncate.

Valves convex in the posterior portion and gibbous in the anterior and umbonal portions.

Beaks sub-anterior, prominent, rising above the hinge-line. Umbonal region regularly gibbous.

Surface marked by regular, sub-equidistant, lamellose, concentric lines and by fine radiating striæ, which are usually interrupted at the edges of the

lamellæ and become thickened at their lower extension. The radii are stronger on the posterior part of the shell.

The hinge structure has the usual characteristics of the genus.

Four specimens measure respectively 35, 33, 23 and 21 mm. in length, and 21, 16, 13 and 10.5 mm. in height.

This species differs from *M. Chemungensis* in its wider posterior end, the absence of a constriction in the basal margin, more ovate form and the regular concentric varices.

Formations and localities. This species occurs in the Hamilton group in most of the localities from Schoharie county to the centre of the State, but it is not very abundant. The greater number have been obtained in Onondaga county and at Canandaigua and Seneca lakes, N. Y. It has been observed in collections from the Hamilton group, near Cumberland, Md. A form undistinguishable from this species occurs in the soft shales at Bedford, Cuyahoga county, O.

Macrodon Chemungensis.

PLATE LI, FIGS. 11-16.

Macrodon Chemungensis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 14. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 51, figs. 11–16. 1883.

Shell of medium size or larger, arcæform; cardinal and basal margins subparallel; length more or less than twice the height; basal margin nearly straight or gently curving with a slight constriction anterior to the middle. Posterior end broad, sub-truncate or sometimes rounded. Cardinal margin straight, extremities angular. Anterior end rounded below, truncate above.

Valves convex in the posterior portion, becoming gibbous in the middle and anterior.

Beaks sub-anterior, prominent, rising a little above the hinge-line.

Umbonal region gibbous, with a prominent, undefined ridge extending toward the post-inferior extremity, and a vertical depression extending from the umbo to the base.

Surface marked by irregular, concentric, lamellose lines of growth.

Three specimens measure respectively 31, 27 and 22 mm. in length, and 14, 15 and 10 mm. in height.

This species is distinguished by its parallel basal and cardinal margins, the truncated posterior end and its narrow form. It resembles *M. parvus* (WHITE and WHITFIELD), of the yellow sandstone of Burlington, Iowa, but it is a much larger form and the beaks are more anterior.

Formation and localities. In the Chemung group, at Buck's quarry, near Elmira, at Philipsburgh, Rockville, Chemung creek and Leon, N. Y.; also at Meadville, Pa.

MACRODON OVATUS.

PLATE LI, FIG. 8; AND PLATE XCIII, FIG. 16.

Macrodon ovatus, HALL. Prelim. Notice Lamellibranchiata, 2, p. 15. 1870.

SHELL small, ovate, wider behind; length once and a half the height; basal margin gently curving with a slight constriction anterior to the middle; posterior margin regularly rounded below and obliquely truncate above. Cardinal line very gently arcuate. Anterior end short and narrowly rounded.

Valves convex, very gibbous above the middle and in the umbonal region.

Beaks sub-anterior, prominent, rising a little above the hinge-line. Umbonal region gibbous with sometimes an undefined ridge extending obliquely backward to the basal margin, anterior to which is a gentle constriction, (too strongly represented in the figure).

Surface marked by concentric lines of growth, which appear to have been lamellose; there is no evidence of radiating striæ in the specimens examined.

Anterior hinge-teeth minute, oblique; posterior teeth elongate, very slightly curved, one long and one short in each valve.

Three specimens measure respectively 18.5, 15 and 15 mm. in length, and 12, 19 and 9 mm. in height.

This species differs from *M. Hamiltoniæ* in its shorter form, gently curving hinge, apparent absence of radiating striæ, and in not having the regular concentric varices of that species.

Formation and localities. In the Waverly sandstones, at Granville and Newark, O.

PTYCHODESMA, Hall and Whitfield. 1872.

Ptychodesma Knappianum.

PLATE LI, FIGS. 22-27.

Ptychodesma Knappianum, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 192. 1872.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 51, figs. 22–27. 1883.

Shell obliquely sub-ovate; length usually more than one-third greater than the height; basal margin oblique, often nearly straight in the middle of its length. Posterior end broadly rounded. Cardinal line straight, oblique, having a length posterior to the beaks of about one-half the length of the shell. Anterior end very short, curving downward into the basal margin without limitation.

Valves convex in the lower and posterior portions, gibbous in the middle and above.

Beaks sub-anterior, small, distant, closely incurved, rising but little above the hinge-line. Umbonal slope presenting an undefined ridge, which merges into the general convexity of the shell about the middle of its length.

Test thick, marked by fine concentric striæ, with distant imbricating lamellæ. The anterior and basal margins are thickened and present the edges of numerous lamellæ of growth.

Ligamental area deeply excavated, marked by numerous longitudinal striæ, which are abruptly arched just beneath the beak. Hinge with two or more cardinal teeth. Anterior muscular impression strong.

Three specimens measure respectively 43, 38 and 35 mm. in length, and 28, 28 and 27 mm. in height.

This shell bears some resemblance externally to several forms of Modiomorpha and Nyassa, but the deeply grooved ligamental area is a distinctive feature.

Formation and localities. In the cherty layers of the age of the Hamilton group, from the Falls of the Ohio, and Dublin, Ohio. A form of this genus occurs in the Hamilton group, in the State of New York, at several localities;

but the material at hand is too obscure to warrant its separation as a distinct species.

Ptychodesma minor.

PLATE XLI, FIG. 27.

Ptycholesma? minor, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 41, fig. 27. 1883.

Shell small, sub-ovate; length about one-third greater than the height; basal margin regularly rounded. Posterior extremity somewhat abruptly rounded, and extended in the middle. Cardinal line short, oblique. Anterior end short, regularly rounded below the beaks.

Valves regularly convex in the basal and posterior portions, gibbous in the middle and in the umbonal region.

Beaks anterior, prominent, incurved. An undefined sub-angular umbonal ridge extends to the post-inferior extremity of the shell.

Surface marked by fine concentric striæ. Interior unknown.

The specimen figured has a length of 16.5 mm., and a height of 11 mm.

This species is distinguished by the slight obliquity of the body of the shell to the hinge-line, the extension of the shell in the middle of the posterior margin, the forward direction of the beaks, and the strong umbonal ridge.

Formation and locality. In the shales of the Chemung group, near Elmira, N. Y.

Ptychodesma nanum, n. sp.

PLATE XCIII, FIGS. 17, 18.

Shell small, broad-ovate; length about one-fourth greater than the height; basal margin broadly rounded posteriorly, with a sinus toward the anterior end. Posterior extremity regularly and broadly rounded, recurving to the cardinal line. Cardinal line short, oblique. Anterior end short and abruptly rounded below the beak.

Valves moderately convex in the posterior and lower part, becoming gibbous in the umbonal region.

Beaks anterior, directed upward, rising but little above the hinge-line. Umbonal slope rounded.

Surface marked by fine, regular, concentric striæ. Interior unknown.

Three specimens measure respectively 10, 15 and 16 mm. in length, and 8, 11 and 12 mm. in height.

This species resembles *P. Knappianum* in form, but has a much more distinct sinus in the anterior portion of the valves, and so far as observed has maintained its small size, never exceeding 16 mm. in length in a collection of more than thirty specimens.

Formation and locality. In the lower part of the Chemung group, at Ithaca, N. Y.

NYASSA, Hall. 1870.

Nyassa arguta.

PLATE LIII, FIGS. 7-20.

Nyassa arguta, Hall. Prelim. Notice Lamellibranchiata, 2, p. 28. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 53, figs. 9-20. 1883.

Shell of medium to large size, elongate sub-elliptical or ovate-arcuate; length about twice the height; basal margin nearly straight, often slightly arcuate or contracted posterior to the middle, abruptly recurved at the post-inferior extremity; posterior margin curved or obliquely sub-truncate. Cardinal line gently arcuate. Anterior end narrowed and abruptly rounded.

Valves depressed below, gibbous above and in the umbonal region.

Beaks sub-anterior, small, closely appressed, rising but little above the hinge-line. Umbonal ridge prominent, rounded or sub-angular, arcuate, extending to the post-inferior extremity; below and parallel with the ridge there is a flattening or depression of the shell extending from the beaks and producing a constriction or sinuosity in the basal margin.

Test thick, marked by lamellose concentric lines of growth, without other ornamentation.

The hinge is characterized by numerous small teeth or callosities beneath the beak, which appear to be without special arrangement, the posterior ones being directed backward and sometimes more elongated. Lateral teeth two or three in number, parallel and extending nearly to the post-cardinal

extremity. Anterior muscular impression deep and strong. Pallial line simple, often strongly marked in the anterior part of the shell. Posterior muscular impression situated on the cardinal slope, not strongly marked. Ligament narrow, external.

Five specimens measure respectively 21, 28, 45, 47 and 52 mm. in length, and 11, 16, 22.5, 24 and 24.5 mm. in height.

This species is distinguished from *N. recta* by its arcuate, sub-elliptical form, sinuate basal margin, and larger size.

Formation and localities. In the arenaceous shales of the Hamilton group, in Schoharie, Otsego, Madison and Onondaga counties, and abundant in some calcareous layers of the group at Pratt's falls, in Onondaga county, N. Y.

Nyassa subalata.

PLATE LIII, FIGS. 21–26.

Nyassa subalata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 29. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 53, figs. 21–26. 1883.

Shell of medium size or larger; body broadly sub-ovate, and including the alation, rhomboidal in outline; length one-third greater than the height; basal margin regularly rounded and sometimes nearly straight in the middle, abruptly recurving at the post-inferior extremity; posterior end oblique, broadly truncate, with the margin slightly convex. Cardinal line oblique, usually alate posteriorly. Anterior end short, narrowed and regularly rounded below the beak.

Valves moderately convex below, becoming gibbous above and in the umbonal region.

Beaks sub-anterior, small, appressed, rising but little above the hinge-line. Umbonal ridge rounded, undefined, merging into the general convexity of the shell before reaching the post-inferior extremity.

Test thick anteriorly, marked by fine, irregular, concentric striæ which are often raised into strong fascicles along the basal and posterior margins. A single young individual shows distinct, continuous, distant radii on the

posterior slope reaching to the posterior margin. This feature is also obscurely shown on several of the older individuals (erroneously represented in fig. 21).

Cardinal teeth not determined. One or two lateral teeth are present on the cardinal alation, extending nearly to the posterior extremity. Anterior muscular impression strong.

Five characteristic specimens measure respectively 23, 36, 38, 39 and 41 mm. in length, and 16, 24, 25, 27 and 28 mm. in height.

This species is readily distinguished from the known species of the genus by its short, broad form and alate post-cardinal extension.

Formation and localities. In the shales of the Hamilton group, at Fultonham and Summit, Schoharie county, N. Y.

Nyassa recta.

PLATE LIII, FIGS. 1-6.

Nyassa recta, Hall. Prelim. Notice Lamellibranchiata, 2, p. 29. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 53, figs. 1–8. 1883.

Shell small or of medium size, ovate sub-cuneate; length nearly twice the height; basal and cardinal margins sub-parallel; basal margin gently curving or often nearly straight, abruptly recurved at the post-inferior angle and more gently curving at the anterior end. Posterior extremity obliquely truncate. Cardinal line straight or slightly arching, and declining toward the posterior end. Anterior end short, narrowed and regularly rounded below the beaks.

Valves regularly convex in the lower part, gibbous above and in the umbonal region.

Beaks sub-anterior, prominent, rising above the hinge-line. Umbonal ridge direct to the post-inferior extremity, with usually a slight flattening or depression in the shell below the ridge, which extends from the umbo to the base, scarcely constricting the margin.

Surface marked by fine, closely arranged, concentric striæ, which become crowded and fascicled at irregular distances.

Anterior muscular impression strongly marked, situated close within the anterior margin of the shell. The posterior extension of the cardinal line is marked by two distinct lateral teeth.

Four specimens measure respectively 20, 21, 24 and 28 mm. in length, and 10, 11, 12 and 15 mm. in height.

This species is distinguished from *N. arguta* in its smaller size; by its straight hinge-line, more prominent beaks, the direct umbonal ridge and the absence of distinct constriction in the basal margin.

Formation and localities. In the softer shales and also the arenaceous beds of the Hamilton group, near Fultonham and Summit, Schoharie county, N. Y.

NYASSA ELLIPTICA.

PLATE XXXIV, FIG. 8.

Nyassa elliptica, HALL. Prelim. Notice Lamellibranchiata, 2, p. 30. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 34, fig. 8. 1883.

SHELL of medium size, broadly elliptical in outline; length and height as 7 to 4; basal margin regularly curving; posterior extremity regularly rounded. Cardinal line gently arcuate from the beaks to the posterior extremity. Anterior end short, regularly rounded below the beak.

Posterior and basal portions of the shell gently convex, becoming more convex above and moderately gibbous in the umbonal region.

Beaks sub-anterior, appressed, rising but little above the hinge-line. Umbonal slope marked by an undefined rounded ridge which extends toward the post-inferior extremity, but merges into the general convexity a little beyond the middle; sometimes a slight depression below the umbonal ridge, extending half way to the post-inferior extremity.

Test of moderate thickness, marked by fine concentric striæ of growth. The specimen is a cast of the interior, preserving a small portion of the shell.

Anterior muscular impression strong, situated just within the border of

the shell. Some portions of the shell preserved along the cardinal line give indications of one or more lateral folds or teeth.

The specimen described has a length of 35 mm. and a height of 20 mm.

This species differs from all the others here described in its regular elliptical form. Although its identity with NYASSA is not fully established, there seems no sufficient reason to doubt its relations to this genus.

Formation and locality. In the Corniferous limestone, at Stafford, Genesee county, N. Y.

GRAMMYSIA, DE VERNEUIL. 1847.

a. cingulata.

GRAMMYSIA OVATA, n. sp.

PLATE XCIII, FIG. 22.

SHELL of medium size, ovate; length about one-third greater than the height; basal margin broadly curving with a slight constriction near the middle. Posterior extremity abruptly recurved from the base and obliquely sub-truncate above. Cardinal line nearly straight, slightly declining posteriorly. Anterior end short, regularly rounded below the lunule.

Valves regularly convex in the lower and posterior portions, gibbous in the middle and above.

Beaks sub-anterior, moderately prominent. Cincture shallow, distinctly defined above, extending from the beak obliquely to the basal margin, at about the middle of its length. Umbonal slope sub-angular, continuing to the post-inferior extremity.

Surface marked by fine concentric striæ, which on the anterior and umbonal portions are fasciculate, rising into sub-angular folds or ridges. Interior unknown.

The specimen described has a length of 60 mm. and a height of 38 mm.

This species bears some resemblance to *G. bisulcata*, but is a proportionally longer shell, the cincture is shallower, and there are no accompanying folds or

plications. In its general form it also somewhat resembles *G. Canadensis* of Billings, but is otherwise very distinct.

Formation and locality. In the Corniferous limestone, Delaware, O.

Grammysia bisulcata.

PLATE LIV, FIGS. 1-16; PLATE LVI, FIG. 1; AND PLATE XCIII, FIG. 25.

Pholadomya anomala, Goldfuss. Pet. Germ., p. 272, pl. 157, fig. 9. 1834–1840.
Pterinea bisulcata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 116. 1838.
Cypricardites bisulcata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 52. 1841.
Grammysia Hamiltonensis, De Verneuil. Bull. Soc. Geol., France, 2d ser., vol. iv, p. 696. 1847.
Cardinia Hamiltonensis, D'Orbigny. Prod. Paléon., vol. 1, p. 76. 1850.
Grammysia bisulcata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 49. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 54, figs. 1–16; pl. 56, fig. 1. 1883.
Compare *Nucula cingulata*, Hisinger. Leth. Svecica, pl. 39, fig. 1; supplement, p. 6. 1837.

Shell large, ovoid; length once and a half the height; basal margin broadly curved, with a constriction near the middle of its length; posterior margin abruptly rounded below and broadly curving or sub-truncate above. Cardinal line nearly straight, more than half as long as the shell. Anterior end abruptly rounded below the deep lunule.

Valves regularly convex below and gibbous or ventricose in the middle and above.

Beaks sub-anterior, strong, incurved over the cardinal line. Umbo prominent, gibbous, with a cincture consisting of a strong fold with a furrow on each side, extending from the beak to the basal margin at about the middle of its length; this feature, alternating on the two sides, gives a sinuosity to the line of junction of the valves.

Entire surface marked by fine concentric striæ, which, on some portions of the shell, are aggregated into fascicles; and by strong, regular, persistent, concentric ridges or folds, which are stronger upon the anterior part of the shell and distinctly undulated in crossing the cincture. The undulations occasionally become obsolete in the lower and posterior part of the shell, and sometimes are to be seen only on the anterior and umbonal portion. In well-preserved specimens the surface, especially in the umbonal region, is also

marked by very fine, radiating, granulose striæ which may be more or less interrupted by the concentric undulations.

Ligamental area deep and strong. Anterior muscular impression sub-circular, placed just within the anterior margin. Posterior scar large and shallow, situated about one-third the length of the shell from the posterior extremity. Pallial line simple.

Four characteristic specimens measure respectively 52, 53, 57 and 75 mm. in length, and 38, 35, 34 and 50 mm. in height. A specimen preserving its normal form and proportions has a length of 70 mm., height 45 mm., and a depth to both valves of 37 mm.

In well-preserved specimens, this species is distinguished by the strong cincture with parallel furrows extending to the base. It differs from *G. elliptica* in its more elongate form, less elevated and incurved beaks, less prominent umbo and greater development of the concentric undulations.

Formation and localities. In the arenaceous shales of the Hamilton group, in Schoharie, Otsego, Madison and Onondaga counties, and rarely in the softer beds of the group in Ontario and other counties in the western part of the State.

Grammysia nodocostata.

PLATE LV, FIGS. 1-11; PLATE LVI, FIGS. (2, 3?); AND PLATE LVII, FIGS. 7, 8.

Grammysia nodocostata, Hall. Prelim. Notice Lamellibranchiata, 2, p 50. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 55, figs. 1–11. 1883.

Shell varying from medium size to very large; obliquely sub-ovoid; length about one-third greater than the height; basal margin broadly curving, flattened or constricted near the middle; posterior margin abruptly rounded below, and obliquely truncate above. Cardinal line straight, bordered by a well-defined escutcheon. Anterior end abruptly rounded below the lunule.

Valves regularly convex below and in the posterior portion, becoming gibbous or ventricose above and in the umbonal region. Often extremely gibbous from vertical compression.

Beaks sub-anterior, prominent and strongly incurved. Owing to pressure they often project beyond the anterior end. Umbo, in its upper portion,

marked by several radiating nodose ridges with intermediate sulci, which, with the exception of a single strong ridge and furrow, become obsolete before reaching the middle of the shell, while the remaining furrow and ridge extend to the base and constrict the margin. The ridge is developed in the right valve, and carries the majority of the nodose radii anterior to it. The deepest furrow is developed in the left valve, and carries the principal part of the nodose radii posterior to it. This feature makes the shell somewhat inequivalve.

Entire surface marked by fine, crowded, concentric striæ, which at somewhat regular intervals are fasciculate and elevated into strong angular ridges or undulations. In the region of the cincture these are crossed and interrupted by radiating ridges extending from the beak, and are more developed in the young shells, and become obsolete below the middle in old shells. Surface also marked by fine radiating pustulose striæ, as shown in fig. 11 of plate lv, but which are more continuous than represented in the figure. Anterior muscular impression sub-circular, situated just within the anterior border of the shell.

Two specimens measure respectively 50 and 80 mm. in length, and 32 and 55 mm. in height. Several large individuals have lengths of about 100 mm. each.

This species resembles *G. bisulcata*, and has generally been confounded with it, but is more oblique, with a shorter hinge-line; the lunule in front of the beaks is smaller; the concentric folds finer and more numerous, besides being angular, lamellose and fasciculate, with a greater number of interstitial ones. The most conspicuous difference is in the oblique folds of the umbo, which become nodose at their intersection with the concentric folds.

The typical forms of this species are very easily distinguished, but in the older shells the characteristic features often become obsolete, and the shells being distorted by pressure are not so easily separable from other species.

Formation and localities. In the shales of the Hamilton group, near Sherburne, Chenango county; Hamilton, in Madison county; Pratt's falls, Onondaga county, and on the shores of Cayuga lake, N. Y.

Grammysia magna.

PLATE LVI, FIGS. 4-7; AND PLATE LVII, FIG. 9.

Grammysia magna, Hall. Prelim. Notice Lamellibranchiata, 2, p. 50. 1870.
In part " " " Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 56, figs. 2–8; pl. 57, figs. 7–10. 1883.

Shell large, broadly ovate or sub-rhomboidal; length more than one-third greater than the height; basal margin gently curving except near the middle, where it is constricted; post-basal extremity abruptly rounded, with the margin sub-truncate above. Cardinal line straight, extending more than half the length of the shell, declining posteriorly. Anterior end short and abruptly rounded below the lunule.

Valves regularly convex on the basal and posterior portion, becoming gibbous in the middle and above.

Beaks sub-anterior, large, prominent and incurved. Cincture in the right valve, a distinct ridge, margined by a depression posterior to it; in the left valve there is a corresponding depression.

Surface marked by fine concentric striæ, which become fasciculate, producing folds or undulations which are conspicuous on the anterior and umbonal portion of the shell, and usually obsolete on the posterior portion. The concentric undulations in crossing the ridge near the beak appear like transverse nodes. Well-preserved specimens show fine radiating striæ crossing the surface, especially in the upper portion. Interior essentially unknown.

Four specimens measure respectively 72, 82, 98 and 100 mm. in length, and 45, 48, 65 and 65 mm. in height.

This is one of the large forms of the genus, and is closely allied to *G. nodocostata*, from which it differs principally in the form and structure of the oblique cincture, which is a simple fold on the right valve and a furrow on the left, and never divided into nodose ridges or accompanied by lines of nodes on the sides, as in that one. The oblique furrow is often exaggerated by the crushing of the shell, the folding taking place along that line.

Notwithstanding these differences, which are sufficiently well marked in

many individuals, it may be suggested that these are only old shells in which the conspicuous markings have become obsolete. An approach to this condition is seen in fig. 8 of plate lvii, which is referred to *G. nodocostata.*

Formations and localities. In the arenaceous shales of the Hamilton group, in Schoharie, Otsego, Chenango, Madison and Onondaga counties, and in the Chemung group at Ithaca, N. Y.

GRAMMYSIA ERECTA.

PLATE LVI, FIG. 8; AND PLATE LVII, FIG. 10.

Grammysia erecta, HALL. Prelim. Notice Lamellibranchiata, 2, p. 52. 1870.
" *magna*, HALL, *in error*. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 56, fig. 8; pl. 57, fig. 10. 1883.

SHELL of medium or large size, erect, sub-triangular; length one-fourth greater than the height; basal margin gently rounded except where slightly sinuated by the cincture near the middle of its length; posterior margin abruptly rounded below and recurving to the cardinal line, which is short. Anterior end below the lunule, broadly rounded.

Valves regularly convex below and gibbous above.

Beaks sub-anterior, very prominent and strongly incurved. Umbo ventricose; umbonal slope rounded and arcuate. Cincture in the right valve, consisting of a fold and shallow furrow on each side, beginning at the beak, and extending in a curving direction to near the middle of the base.

Surface marked by fine concentric striæ, which become fasciculate on the anterior half of the shell, and form strong angular elevations. These concentric undulations extend over the entire umbonal region, and are abruptly sinuate in passing the cincture. Surface also marked by extremely fine radiating striæ.

This species differs from any of those having a cincture, in its erect form and sub-triangular outline. The specimens are distorted and fragmentary, and therefore unsatisfactory.

Formation and locality. In the shales of the Hamilton group, at Fultonham, Schoharie county, N. Y.

Grammysia circularis.

PLATE LVII, FIGS. 3-6; AND PLATE LVIII, FIG. 13.

Grammysia circularis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 51. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 57, figs. 3-6; pl. 58, fig. 13. 1883.

Shell from medium to large size, sub-circular in outline, ventricose; length about one-fifth greater than the height; basal margin regularly rounded, except a slight sinuosity posterior to the middle; posterior margin regularly rounded from the post-inferior extremity to the cardinal line. Cardinal line short and arcuate. Anterior end short and narrow, regularly curving from the lunule into the basal margin.

Valves regularly convex along the lower portion, becoming gibbous and ventricose above and in the umbonal region.

Beaks sub-anterior, prominent and strongly incurved. The beak and umbo marked by a cincture, consisting of a ridge and shallow furrows, which becomes somewhat obsolete on the middle of the valve, but is continued to the basal margin, marking the shell in its passage by an undulation in the striæ which produces a slight projection in the centre, with a shallow constriction posterior to it. These features alternate in the two valves.

Surface marked by fine concentric striæ, which become fasciculate toward the base and on the anterior end, forming distinct ridges or undulations of the surface. No radiating striæ have been observed.

The hinge, as shown in figs. 5 and 6 of plate lvii, has a strongly marked ligamental area extending half the length of the shell, and a well-defined lunule. Figs. 3 and 4 show the anterior muscular impression just within the anterior border and encroaching upon the lunule. The pallial line continues parallel to the basal margin, recurving abruptly and terminating in the large posterior muscular scar on the post-cardinal slope. The course of the pallial line, in the cast, is marked by regular, elongate, pustulose striæ, extending from above and terminating in that line. The interpallial area is marked by numerous elongate pustules.

Three specimens measure respectively 67, 70 and 87 mm. in length, and

55, 59 and 70 mm. in height. A specimen preserving both valves has a length of 53 mm., height 42 mm., and a depth to both valves of 32 mm.

This species is readily distinguished from any of its associated forms by its sub-circular outline, in which character it seldom varies; and also in the absence of a distinct cincture below the middle of the valve.

Formations and localities. In the Hamilton group, in Albany, Schoharie and Madison counties; in the Chemung group, at Nichols, in Tioga county, Cortland, Cortland county, and Ithaca, Tompkins county, N. Y.

GRAMMYSIA ELLIPTICA.

PLATE LVIII, FIGS. 1-12 (1, 5, 6?).

Grammysia elliptica, HALL. Prelim. Notice Lamellibranchiata, 2, p. 53. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 58, figs. 1-12. 1883.

SHELL of medium or large size, transversely elliptical; length varying from one-sixth to one-third greater than the height; basal margin broadly curving, slightly sinuate about the middle; posterior margin abruptly rounded below and curving into the cardinal line above, sometimes more or less truncate. Cardinal line arcuate. Anterior end narrow and abruptly rounded below the lunule.

Valves regularly convex below, becoming more or less gibbous above the middle and in the umbonal region.

Beaks sub-anterior, very prominent, strongly incurved, rising considerably above the hinge-line. Umbonal slope rounded, arcuate. Cincture consisting of a fold and furrow, extending downward in a curving direction to the base of the shell, producing a gentle sinuosity in the basal margin. The fold is more strongly developed in the left valve and the furrow in the right one.

Test thick, marked on the posterior and middle portions of the shell by fine, irregular, concentric striæ, which become aggregated into fascicles on the middle of the shell; and on the anterior part marked by strong concentric undulations. No radiating striæ have been observed.

The hinge of the right valve shows a thickened plate bearing a single angular fold just beneath the beak. Nothing is satisfactorily known about the muscular impressions.

Four specimens measure respectively 31, 57, 65 and 93 mm. in length, and 23, 36, 46 and 63 mm. in height.

This species more nearly resembles *G. circularis* than any other form of the Hamilton and Chemung groups, but it is usually more elliptical in outline and the umbonal ridge is stronger and more distinctly defined. In *G. elliptica* the cincture is usually well defined, while in *G. circularis* it is obscure or obsolescent.

The specimen illustrated in figs. 5 and 6 of plate lviii has the form of *G. circularis*. The cincture is exaggerated in figure 5, being very obscure in the specimen.

Formation and localities. In the Chemung group, at Philipsburgh, Alleghany county; near Ithaca, Tompkins county, N. Y., and near Mansfield, Tioga county, Pa.

b. obsoleta.

Grammysia obsoleta.

PLATE LIX, FIGS. 21-27.

Grammysia obsoleta, Hall. Prelim. Notice Lamellibranchiata, 2, p. 60. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 59, figs. 21-27. 1883.

Shell large, general form broadly ovate, becoming elliptical and sub-rhomboidal from pressure; length more than one-third greater than the height; basal margin regularly rounded, frequently with a slight constriction near the middle. Posterior extremity regularly rounded, curving into the basal margin without limitation. Cardinal line more than half the length of the shell, arcuate, declining toward the posterior extremity. Escutcheon distinctly limited. Anterior end short and abruptly rounded below the lunule.

Valves regularly convex below and posteriorly, becoming gibbous in the middle and above.

Beaks sub-anterior, large, elevated, with the apices strongly incurved.

Umbonal slope rounded, with no defined limitation. There is a scarcely perceptible flattening of the lower part of the shell from below the umbo to the middle of the basal margin — a feature which is not always present. The anterior end of the shell below the beak is marked by a shallow furrow with a ridge on each side extending to the antero-basal margin. The posterior ridge merges into the general convexity of the valve above.

Surface marked by fine, closely arranged, concentric striæ, which are sometimes crowded and fasciculate. The umbonal region and anterior end are sometimes marked by strong, concentric folds.

A specimen of this species has a length of 65 mm. and a height of 45 mm. A larger individual has a length of 70 mm.

In some of its phases this species resembles individuals of *G. elliptica* which have the cincture scarcely developed, as in figs. 1 and 4 of plate lviii, but the broadly rounded posterior extremity of the present species, the sulcate anterior end and constant absence of a cincture are distinguishing characters. It also sometimes assumes the general form of *G. circularis*, but in that species the flattening of the shell and the constriction of the basal margin is posterior to the middle, and it has no anterior fold or sinus.

Formation and localities. In the arenaceous layers of the Hamilton group, in Schoharie, Madison and Onondaga counties; and in the soft shales of the group on the shores of Skaneateles, Seneca and Cayuga lakes, and also near Bellona and Moscow, N. Y.

Grammysia bellatula.

PLATE LXIII, FIGS. 1–3.

Cardiomorpha bellatula, Hall. Prelim. Notice Lamellibranchiata, 2, p. 92. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 1–3. 1883.

Shell small, ovate; length one-third greater than the height; basal margin regularly curved without apparent constriction. Posterior extremity abruptly rounded. Cardinal line straight, extending half the length of the shell. Anterior end short, abruptly rounded below the lunule.

Valves regularly convex below and on the posterior end, becoming gibbous in the middle and umbonal region.

Beaks in advance of the anterior third, prominent and incurved. Umbonal slope not defined.

Surface marked by fine concentric striæ and by angular, somewhat distant, concentric folds, which become obsolete on the middle and posterior parts of the shell. Interior unknown.

Two valves of equal size have lengths of 14 mm. and heights of 10 mm.

Formation and locality. In the shales of the Hamilton group, York, Livingston county, N. Y.

Grammysia Eriopia.

PLATE LXIII, FIGS. 7, 8.

Cardiomorpha Eriopia, Hall. Prelim. Notice Lamellibranchiata, 2, p. 92. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 7, 8. 1883.

Shell above the medium size, sub-circular or very broadly ovate; length about one-fifth greater than the height; basal margin regularly rounded into the broad posterior end. Cardinal line declining toward the posterior extremity. Anterior end short, abruptly rounded below the lunule.

Valves regularly convex below and posteriorly, gibbous in the middle and above.

Beaks at the anterior third or fourth, prominent and strongly incurved. Umbonal ridge merging into the general convexity of the shell. Post-cardinal slope marked by a low ridge which may become obsolete.

Surface marked by fine concentric striæ and by fine, distant, radiating striæ, principally developed on the posterior slope. Also marked by strong, concentric folds which are principally shown on the umbo and the anterior portion of the valve. In young shells the undulations are present on the posterior slope, limited above by the post-cardinal ridge. Interior unknown.

A small specimen has a length of 21.5 mm. and a height of 17 mm. A larger individual has a length of 55 mm.

This species bears some resemblance to *G. obsoleta*, but there is an absence of any anterior radiating folds, the beak is more erect and the concentric

undulations are more strongly marked. It differs from *G. circularis* in the absence of any mesial cincture.

Formation and localities. In the shales of the Hamilton group, on the shores of Canandaigua and Seneca lakes, N. Y.

Grammysia glabra, n. sp.

PLATE XCIII, FIG. 24.

Shell of medium size, ovate; length one-third greater than the height; basal margin regularly convex, with a slight constriction anterior to the middle of its length. Posterior extremity narrowly rounded. Cardinal line arcuate, declining posteriorly. Escutcheon narrow. Anterior end large, declining rapidly from the beaks, and regularly rounded below the lunule.

Valves regularly convex in the lower and posterior portions, becoming gibbous in the middle and above.

Beaks at about the anterior third, large, much elevated above the hinge-line. Umbonal region regularly convex. Umbonal slope rounded, not defined. There is a slight depression extending almost vertically from the umbo, and producing a gentle constriction in the basal margin.

Surface marked by fine, sub-equal, concentric striæ, which become fasciculate, and often rise into low undulations on the anterior portion of the shell. Anterior muscular impression large, situated below the limits of the lunule. Pallial line, in the cast, marked by a row of inconspicuous nodes, following near to the ventral margin. Posterior scar large and superficial, situated on the post-cardinal slope.

Two specimens measure respectively 53 and 57 mm. in length, and 36 and 38 mm. in height.

This species most nearly resembles *G. obsoleta*, but in its natural condition it is not so broadly ovate, and it has no indication of the fold and sinus on the anterior end, as in that species.

Formation and localities. In the upper sandstones of the Chemung group, at Warren, Pa., and doubtfully at Clark's farm, near Panama, N. Y.

c. undulata.

GRAMMYSIA ALVEATA.

PLATE LVII, FIGS. 1, 2; AND PLATE LX, FIGS. 1-11.

Posidonia alveata, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 53. 1841.
Grammysia alveata (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 55. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 57, figs. 1, 2; pl. 60, figs. 1-11. 1883.

SHELL large, ovate-rhomboidal; length more than one-third greater than the height; basal margin regularly curved, abruptly recurving at the post-inferior extremity and broadly truncate above. Cardinal line short, nearly straight; sub-alate at the post-cardinal extremity. Anterior end short, abruptly rounded.

Valves convex below and posteriorly, ventricose above.

Beaks sub-anterior, large, prominent, strongly incurved over the hinge-line. Umbonal slope rounded or sub-angular, extending to the post-inferior extremity. Cardinal slope concave. Cincture obsolete.

Entire surface marked by fine concentric striæ and, anterior to the umbonal slope, by strong, angular, concentric folds or more gentle undulations.

Hinge marked by a thickened plate bearing an obscure fold which is not so strongly marked as in several of the preceding species.

Two specimens measure respectively 68 and 88 mm. in length, and 47 and 62 mm. in height. A specimen preserving both valves has a length of 58 mm., height 42 mm. and depth of 36 mm. Three vertically compressed individuals of large size measure respectively 84, 94 and 104 mm. in length, 34, 58 and 39 mm. in height, and 52, 66 and 57 mm. in the depth of both valves.

This species closely resembles *G. lirata*, and that one may be only a modification and smaller form of this species. In general it may be distinguished by its fewer concentric folds and their entire absence on the posterior slope. It differs from *G. arcuata* in its more erect form and the absence of the concentric folds on the posterior slope.

Formation and localities. Abundant in the arenaceous shales of the Hamilton

group, in Schoharie and Otsego counties, and found in nearly all localities throughout Eastern and Central New York, but seldom in the softer shales in the western part of the State. It also occurs in the shales of the Hamilton group at Patterson's creek, Va.

GRAMMYSIA LIRATA.

[Probably the young of Grammysia alveata.]

PLATE LIX, FIGS. 6-12.

Grammysia lirata, HALL. Prelim. Notice Lamellibranchiata, 2. p. 57. 1870.
" " " Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 59, figs. 6-12. 1883.

A farther examination of this form, with larger collections, indicates that the characters upon which the species was founded may be only those belonging to an immature shell.

In these forms the concentric undulations are comparatively more numerous, and are not so distinctly limited by the umbonal ridge. The numerous and characteristic concentric folds are shown in figs. 6, 7 and 10 of plate lix. The ridge adjacent to the escutcheon, as shown in fig. 10, is due to the vertical compression of the shell, and does not differ from the same part of the shell in *G. alveata* when preserved in similar conditions. The same figure shows the concentric undulations extending over the cardinal slope in a subdued degree, not limited by the umbonal ridge. In figs. 8, 9 and 11, the concentric folds pass over the umbonal slope in a subdued condition, and are not anywhere abruptly terminated by the umbonal ridge as in characteristic specimens of *G. alveata*. In form and other characters these specimens do not differ from that species.

This form is more abundant than any other in the Hamilton group, and is perhaps subject to greater variation from compression than any other of the genus. When occurring in what appears to be its normal condition, the shell is much longer on the posterior end; but many of the individuals in the collection have been so distorted as to leave this part of the shell not more than half as long as the anterior end. The same degree of distortion is liable to occur in the height or depth of the valves, so as to produce an almost endless variety of form.

This species occurs in all the localities cited for *G. alveata*.

Grammysia globosa.

PLATE LXII, FIGS. 10-19.

Grammysia globosa, Hall. Prelim. Notice Lamellibranchiata, 2, p. 57. 1870.
Cardiomorpha cordatus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 62, figs. 10-19. 1883.

Shell below the medium size, sub-globose; valves sub-circular, or very broadly ovate; length a little greater than the height; basal margin regularly rounded, curving into the broad, rounded posterior margin. Cardinal line about half the length of the shell. Escutcheon strongly marked, limited on the exterior by a strong fold, with a smaller intermediate fold. Anterior end somewhat broadly rounded below the lunule, which is distinctly marked and sometimes margined by a narrow fold.

Valves ventricose.

Beaks at about the anterior third, very prominent and incurved. Umbonal slope rounded, not defined from the general convexity of the shell, sometimes with a narrow obsolescent fold.

Surface marked by fine concentric striæ and strong rounded or sub-angular concentric folds, which are sometimes duplicate, all becoming obsolete on the posterior slope. Interior unknown.

Two specimens measure respectively 20 and 28 mm. in length, 20 and 23 mm. in height, and 20 and 20 mm. in the depth of both valves. A larger specimen has a length of 33 mm. and a height of 27 mm.

This species bears some resemblance to the shorter forms of *G. arcuata*, but differs in its ventricose character and circular form. Among all the collections which have been made no individuals have been noticed which are larger than those illustrated on plate lxii.*

Formation and localities. In the shales of the Hamilton group, in Schoharie county; Leonardsville and Hamilton, Madison county, Pratt's falls, Onondaga county, and on the shores of Cayuga and Canandaigua lakes, N. Y.

* The reference to the genus Cardiomorpha, as above cited, arose from copying an erroneous record of the species. At that time, the name *Grammysia globosa*, previously given, was overlooked.

Grammysia zonata.

PLATE LXIII, FIGS. 4, 5.

Cardiomorpha zonata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, fig. 5. 1883.
Cardiomorpha concentrica, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, fig. 4. 1883.

Shell small, ovate-elliptical; length one-third greater than the height; basal margin regularly curving into the anterior and posterior margins without evidence of constriction. Cardinal line nearly straight, slightly declining backward. Anterior end short, abruptly rounded.

Valves moderately convex in the lower and posterior portions, and gibbous in the middle and umbonal region.

Beaks at about the anterior third, directed forward and incurved. Umbonal slope sub-angular above, merging into the general convexity of the shell below. Post-cardinal slope limited below by a strong fold, with a narrow plication between it and the cardinal margin.

Surface marked by fine concentric striæ and strong concentric ridges, which are continuous to the post-cardinal slope. Interior unknown.

The two specimens described measure respectively 13 and 20 mm. in length, and 8.5 and 13 mm. in height.

This species differs from *G. bellatula* in its more elliptical outline, the strong continuous concentric undulations of the surface and the cardinal slope marked by two distinct longitudinal folds.

Formation and locality. In the Hamilton group, near Summit, Schoharie county, N. Y.

Grammysia arcuata.

PLATE LXI, FIGS. 1-9; PLATE LXIII, FIG. 6?; AND PLATE XCIII, FIG. 27.

Posidonia? arcuata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 53. 1841.
Grammysia arcuata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 56. 1870.
" (*Leptodomus*) *arcuata* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 61, figs. 1-9. 1883.
" *donaciformis*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, fig. 6. 1883.

Shell of medium size, ovate; length about one-third greater than the height; basal margin moderately curved, straight or slightly concave along the middle.

Posterior extremity regularly rounded. Cardinal line nearly straight, slightly declining posteriorly. The anterior end varies from regularly and narrowly rounded to obliquely truncate below and abruptly rounded above.

Valves regularly convex below and posteriorly, becoming gibbous above and in the umbonal region.

Beaks sub-anterior, large and prominent, inclined forward. Umbonal ridge not defined; shell usually indistinctly flattened from the beak to the basal margin, which is often constricted by this depression.

Surface marked by fine, close concentric striæ and by strong rounded or sub-angular concentric undulations, which are usually continuous from the lunule to the margin of the escutcheon. These undulations are sometimes duplicated, or others intercalated on the anterior half of the shell, which are thence continuous to the posterior termination. In some older specimens these ridges become obsolete on the umbonal slope. Test also marked by fine, distant radiating striæ, which have been observed only on the posterior slope.

Lunule large but not distinctly limited. Escutcheon, in well-preserved specimens, very distinctly defined by a broad depression margined longitudinally on each side by a low ridge. Characters of the interior unknown.

Five specimens measure respectively 34, 38, 40, 45 and 57 mm. in length, and 22, 26, 26, 28 and 35 mm. in height.

This species differs from *G. alveata* in its more elongate form, more rounded posterior extremity, flattened or constricted basal margin, and in having the concentric folds usually extending with nearly undiminished strength across the umbonal slope.

Formation and localities. In the arenaceous shales of the Hamilton group, in Schoharie county, and common in the softer shales in central and western New York. It has also been obtained from the soft shales of this group at Patterson's creek, Virginia, and in the cherty layers above the Corniferous limestone at the Falls of the Ohio.

Grammysia subarcuata.

PLATE LXI, FIGS. 10–22; AND PLATE XCIII, FIG. 26.

Grammysia subarcuata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 61. 1870.
Grammysia (Leptodomus?) subarcuata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 61, figs. 10–22. 1883.

Shell of medium size, sub-ovate, widest at the posterior end; length more than one-third greater than the height; basal margin regularly convex, sometimes straight or constricted toward the anterior end. Posterior extremity rounded, or obtusely sub-angular, often sub-truncate above. Cardinal line nearly straight. Anterior end short, abruptly rounded below the lunule.

Valves moderately convex in the lower and posterior part, becoming gibbous in the middle and umbonal region.

Beaks sub-anterior, prominent, inclining forward and strongly incurved. Umbonal slope rounded. Post-cardinal slope flattened or concave, sometimes limited by an elevation, at which line the concentric undulations terminate. Anterior to the middle of the shell, extending from the beak to the basal margin, there is a depression or cincture which often gives a slight undulation to the concentric folds and a constriction to the margin.

Surface marked by fine, close concentric striæ and by strong sub-angular concentric ridges or folds, which are frequently duplicate posterior to the cincture. The surface is also marked by fine, radiating, pustulose striæ, which are often very conspicuous. Interior unknown.

Three specimens measure respectively 36, 38 and 48 mm. in length, and 20, 23 and 33 mm. in height. The largest specimen observed has a length of 70 mm.

This species resembles *G. arcuata* in its general aspect, but differs in its more elongate form, more pointed posterior end, and the cincture is much more strongly marked.

Formation and localities. In the arenaceous layers of the Chemung group, at Ithaca, near Elmira, Portville and Chemung, N. Y.

d. elongata.

Grammysia præcursor.

PLATE LIX, FIG. 1.

Grammysia præcursor, Hall. Prelim. Notice Lamellibranchiata, 2, p. 54. 1870.
Grammysia (Leptodomus?) præcursor, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 59, fig. 1. 1883.

Shell small, transversely ovate; length nearly twice the height; basal margin regularly curved with a slight sinus anterior to the middle. Posterior extremity sub-angular. Cardinal line straight. Anterior end short, narrowly rounded below the distinct lunule.

Valves regularly convex below and posteriorly, becoming very gibbous in the middle and above.

Beaks sub-anterior, prominent and strongly incurved. Umbonal slope sub-angular. A shallow, indistinct cincture crosses the valve about one-third of its length from the anterior end.

Surface of the valves marked by numerous concentric folds, which are sharp on the anterior end of the shell, becoming more distant and rounded toward the umbonal slope, and partially obsolete near the posterior extremity, with a few interstitial ridges rising anterior to the middle of the valve.

Some portions of the shell still remaining on the cast show fine concentric striæ, with finer radiating lines. Interior unknown.

The specimen described has a length of 30 mm. and a height of 16 mm.

In some of its characters this species bears a slight resemblance to *G. arcuata*, but the undulations are finer, the valves narrower behind and marked by a distinct sub-angular umbonal slope.

Formation and locality. In the Schoharie grit, at Schoharie, N. Y.

Grammysia secunda.

PLATE LIX, FIGS. 2, 3.

Grammysia secunda, Hall. Prelim. Notice Lamellibranchiata, 2, p. 54. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 59, figs. 2, 3 (4, 5 in error). 1883.

Shell small, sub-elliptical; length about twice the height; basal margin gently curving, with a distinct sinuosity near the anterior end. Posterior extremity

sub-angular, truncate above. Cardinal line straight, nearly two-thirds the length of the shell. Anterior end short, regularly rounded.

Valves regularly convex below and posteriorly, becoming moderately gibbous in the middle and above.

Beaks sub-anterior, not prominent, incurved. Umbonal slope angular, extending to the posterior extremity, with a distinct fold above the middle of the cardinal slope, and only slightly divergent from the cardinal line.

Surface of the cast marked by strong concentric folds, which are angular on the anterior end, but become broader and rounded as they approach the umbonal ridge, beyond which they are obsolete.

Ligamental area deeply marked. Other characters of the interior unknown.

The specimen described has a length of 33 mm. and a height of 18 mm.

This species differs from *G. præcursor* in being less ventricose, in having stronger and less numerous concentric folds, and a more defined cincture; and from *G. arcuata* in the distinct umbonal ridge, and much stronger post-cardinal fold.

Formation and locality. In the Upper Helderberg limestones, at Clarence Hollow, Erie county, N. Y.

GRAMMYSIA CONSTRICTA.

PLATE LIX, FIGS. 13-20, (4, 5?); AND PLATE LXXVIII, FIGS. 26, 27.

Grammysia (Lyrodomus?) constricta, HALL. Prelim. Notice Lamellibranchiata, 2, p. 58. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 59, figs. 13-20 1883.
Pholadella constricta, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 26, 27. 1883.

SHELL small, or below the medium size, narrowly ovate, widest in front; length nearly twice the greatest height; basal margin gently curving, with a distinct sinus a little anterior to the middle. Posterior extremity sub-cuneate, narrowly rounded. Cardinal line essentially straight, somewhat rapidly declining toward the posterior end. Anterior end short, rapidly declining from the beaks, sub-truncate above and rounded below.

Valves moderately convex, below and posteriorly, becoming gibbous above the middle.

Beaks sub-anterior, prominent, closely incurved and rising above the hinge-line. Umbonal slope rounded, prominent near the beaks, but gradually merging into the general convexity about the middle of the length of the shell. There is a distinct cincture extending a little backward from the beaks to the basal margin.

Surface marked by fine concentric striæ, and extremely fine, pustulose, radiating striæ; also by strong concentric undulations, which are sometimes duplicate or intercalate near the anterior end and rarely in the middle of their length, becoming obsolete before reaching, or upon, the post-cardinal slope. The undulations are often a little deflected on the line of the cincture.

Ligamental area distinct and elongate. Characters of the interior unknown.

One specimen has a length of 40 mm. and a height from beak to base of 22 mm. A smaller individual has a length of 20 mm. and a height of 13 mm.

This species is easily distinguished from any in the Hamilton group by the strong, nearly vertical, mesial cincture and elongate form.

The cincture in *G. subarcuata* is much farther anterior than in this species.

From *G. communis* it is distinguished by the greater distance of the beaks from the anterior end; by its narrower posterior extremity, and by the more nearly vertical direction of the mesial cincture.

Formation and localities. In the arenaceous beds of the Hamilton group, near Fultonham, and other parts of Schoharie county, and in the soft shales of the formation on the shores of Seneca and Canandaigua lakes, N. Y.

Grammysia communis, n. sp.

PLATE LXI, FIGS. 24-28; AND PLATE XCIII, FIG. 20.

In part *Grammysia Hannibalensis*, (Shumard), Hall. Prelim. Notice Lamellibranchiata, 2, p. 62. 1870.
" *Grammysia (Leptodomus?) Hannibalensis*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 61, figs. 23-33. 1883.
Not *Allorisma Hannibalensis*, Shumard. Geol. Surv. Missouri, Rep., pt. ii, p. 206, pl. c, fig 19. 1855.

Shell small, ovate-cuneate; length less than twice the height; basal margin gently curving with a slight constriction just anterior to the middle of the

length, abruptly recurving at the post-basal extremity and obliquely truncate above. Cardinal line nearly straight, scarcely declining posteriorly. Anterior end short, obliquely truncate above, at the lunule, and abruptly rounded below, having an angle at the junction of the two lines.

Valves regularly convex in the lower and posterior portions, becoming gibbous above and especially on the post-umbonal slope.

Beaks sub-anterior, prominent, large, strongly incurved. Umbonal slope obtusely sub-angular, and extending to the posterior extremity, with a faint indication of a plication on the post-cardinal slope. Valves marked by a distinct cincture extending from the beak, more or less obliquely, to the basal margin anterior to the middle of its length.

Surface marked by fine concentric striæ, which are obscurely visible in the cast; and by strong concentric undulations which mark the anterior and central portion of the valves, becoming obsolete on the umbonal ridge. Interior unknown.

Five specimens measure respectively 29, 30, 32, 35 and 44 mm. in length, and 17, 17, 21, 17 and 24 mm. in height.

This shell has been identified as *Grammysia* (*Allorisma*) *Hannibalensis*, of Shumard, but compared with authentic examples of that species from the original locality it is found to differ in its more elongate form, sub-angular umbonal slope, more oblique cincture, and more strongly defined concentric folds.

Formation and localities. In the Chemung group, at New Albion, Olean, Portville, and Little Genesee, N. Y.; and at Warren, Pa.

Grammysia undata.

PLATE LXI, FIG. 23; PLATE LXIV, FIG. 30; AND PLATE XCIII, FIG. 21.

Edmondia undata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, fig. 30. 1883.

Shell below the medium size; ovate sub-elliptical; length about one-third greater than the height; basal margin gently curving, nearly straight, and slightly constricted anterior to the middle of its length. Posterior margin

curving upward to about the middle of its height, above which it is obliquely sub-truncate. Cardinal line straight, more than two-thirds the length of the shell, slightly declining posteriorly. Anterior end short, regularly rounded.

Valves regularly convex in the lower and posterior portion, becoming gibbous in the middle and above.

Beaks at about the anterior third or fourth, rather prominent. Umbonal slope sub-angular above, and sometimes continued obscurely to the post-inferior extremity. Cincture broad, undefined, extending from the beaks to the base anterior to the middle, and producing a flattening of the valve and a slight constriction of the basal margin.

Surface marked by fine concentric striæ, with a few, more or less distinct, concentric undulations, which become obsolete at about the umbonal angle. Interior unknown.

Three specimens measure respectively 21, 25 and 30 mm. in length, and 14, 16 and 21 mm. in height.

This species resembles *G. communis*, but the concentric undulations are not so numerous, the umbonal slope less defined, the posterior end broader and not so obliquely truncate above the middle, and the cincture more nearly vertical.

Formation and localities. In the conglomerate of the Chemung group, at Panama, and four miles north of Panama, N. Y.; in the same horizon, at Alleghany Springs, Warren county, Pa.; also in some shaly sandstones, near Salamanca, and in the conglomerate, at Portville, N. Y.

Grammysia duplicata, n. sp.

PLATE XCIII, FIG. 23.

Shell small, ovate, abruptly depressed and cuneate behind; length more than one-third greater than the height; basal margin regularly curved with a scarcely perceptible sinus anterior to the middle. Posterior extremity abruptly rounded below and shortly truncate above. Cardinal line straight, margined by a narrow escutcheon. Anterior end about one-third the length of the shell, pointed, truncate below the lunule. Margin of the lunule nearly straight and slightly declining.

Valves regularly convex toward the ventral margin, depressed-convex at the posterior end and ventricose in the middle and above.

Beaks at about the anterior third, large and prominent, incurving over the hinge-line. Umbonal slope convex, gibbous above and gradually declining into the general surface of the shell. Cardinal slope marked by one or two inconspicuous folds. Cincture vertical, not strongly defined.

Surface marked by fine concentric striæ and by numerous concentric folds, which are strong and angular upon the anterior end, becoming regularly bifurcated along the line of the cincture and thence continued to the post-cardinal slope where they become rather abruptly obsolete. Interior unknown.

The specimen described has a length of 28 mm. and a height of 17 mm.

This species is distinguished by the regular duplication of the concentric folds along the cincture. It is more gibbous than either *G. communis* or *G. Hannibalensis*, more abruptly depressed at the posterior extremity, and distinctly angular at the anterior end, a feature observed only in the first species here cited.

Formation and locality. In the upper beds of the Chemung group, at Warren, Pa.

Grammysia Hannibalensis.

PLATE LXI, FIGS. 29, 30, 33.

Allorisma Hannibalensis, Shumard. Geol. Surv. Missouri, Rep., pt. ii, p. 206, pl. c, fig. 19. 1855.
In part *Grammysia Hannibalensis* (Shumard), Hall. Prelim. Notice Lamellibranchiata, 2, p. 63. 1870.
" " ? " " Meek. Pal. Ohio, vol. ii, p. 300. Pl. 16; figs, 5a, b, c. 1875.
" " (*Leptodomus?*) *Hannibalensis* (Shumard), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 61, figs. 23–33. 1883.

Shell below medium size, narrowly ovate or sub-elliptical; length more than one-third greater than the height; basal margin gently curved, more abruptly curving at the anterior end, with a gentle sinus anterior to the middle. Posterior extremity regularly rounded to about the middle of its height and sub-truncate above. Cardinal line straight, extending more than half the length of the shell. Anterior end abruptly rounded below the lunule.

Valves regularly convex, becoming gibbous above the middle and in the umbonal region.

Beaks in advance of the anterior third, moderately elevated and incurved, rising but little above the hinge. Umbonal slope rounded, not defined. A broad gentle cincture extends from the beak to the ventral margin anterior to the middle of the length.

Surface marked by fine, closely arranged, fasciculate concentric striæ, and by stronger concentric folds, which are more distinctly developed in the anterior and umbonal region. Frequently the concentric folds are very irregular in their development, often bifurcating on the anterior part of the valves and becoming obsolete before reaching the umbonal slope.

Ligamental area narrow. Other characters of the interior unknown.

Three specimens have lengths of 40 mm. each and heights of 25 mm. Two smaller individuals measure respectively 33 and 38 mm. in length and 19 and 22 mm. in height.

This species bears some resemblance to *G. subarcuata*, but is proportionally more elongate and the concentric folds are much more strongly developed.

Formations and localities. In the Waverly sandstones, at Summit and Cuyahoga Falls, O., and in the Lithographic limestone at Hannibal, Mo.

Grammysia plena, n. sp.

PLATE LXI, FIGS. 31, 32.

In part *Grammysia Hannibalensis* (Shumard), Hall. Prelim. Notice Lamellibranchiata, 2, p. 62. 1870.
" " (*Leptodomus?*) *Hannibalensis* (Shumard), Hall. Pal. N.Y., vol. v, pt. 1. Plates and Explanations: Pl. 61, figs. 23–33. 1883.
Not *Allorisma Hannibalensis*, Shumard. Geol. Surv. Missouri, Rep., pt. ii, p. 206, pl. c, fig. 19. 1855.

Shell below the medium size, ovate; length about one-third greater than the height; basal margin regularly curved from the post-basal extremity, excepting a gentle constriction, or sinus, at about the anterior third. Posterior extremity obliquely truncate above. Cardinal line straight, more than half the length of the shell. Anterior end short, abruptly rounded below the lunule. Lunule deep and distinct, extending more than half way from the beak to the base of the shell.

Valves regularly convex in the posterior portion, becoming very gibbous and ventricose in the middle and umbonal region.

Beaks sub-anterior, prominent and strongly incurved. Umbonal slope sub-angular, extending to the post-inferior extremity, producing a slight angularity in the margin. Post-cardinal slope broad, marked by a distinct fold along the middle, which produces an undulation in the margin of the shell. A shallow cincture extends from the beak, reaching the ventral margin at about the anterior third.

Surface marked by fine concentric striæ, which are somewhat fasciculate on the posterior portion of the shell, and by fine radiating pustulose striæ in well-preserved specimens. The anterior half of the shell is marked by strong sub-angular folds, or undulations, which become obsolete on the middle of the shell, or sometimes extending to the umbonal angle. These concentric folds are frequently bifurcate at or about the cincture. Interior essentially unknown.

Two specimens measure respectively 36 and 39 mm. in length, and 22 and 22 mm. in height.

This species more nearly resembles *G. Hannibalensis* than any other, but the shell is more gibbous, the cincture is stronger, the posterior extremity very distinctly truncate and the post-cardinal slope with a more or less defined fold.

Formation and locality. In the yellow sandstones at Burlington, Iowa.

Grammysia (Sphenomya) cuneata.

PLATE LXII, FIGS. 1-9; AND PLATE XCIII, FIG. 19.

Grammysia (Sphenomya) cuneata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 62, figs. 1-9. 1883.

Shell of small or medium size; ovate-cuneate, very oblique; length more than one-half greater than the height; basal margin regularly curved, with sometimes a visible constriction toward the posterior end. Posterior end narrowly rounded at the extremity and obliquely truncate above. Cardinal line short; margins apparently not inflected. Escutcheon large, limited by an indistinct groove and fold. Anterior end very short, abruptly rounded below the lunule.

Valves moderately convex below and posteriorly, gibbous in the middle and umbonal region.

Beaks anterior, directed forward and strongly incurved. Umbonal slope sub-angular, extending to the posterior margin above its greatest extension; above this there is another sub-angular fold. Post-cardinal area very wide. Cincture obscure, often obsolete, continuing as an undefined depression from the umbo to the basal margin near the posterior extremity.

Surface marked by very fine, regular concentric striæ, and upon the anterior portion of the shell by angular concentric undulations, which become obsolete on the posterior slope, usually between the cincture and the umbonal ridge; these undulations are rarely duplicate in the upper and middle portions of the shell. In well-preserved specimens extremely fine radiating striæ have been observed on the post-cardinal slope, which may also extend to other portions of the shell. In many specimens there are a few continuous, stronger radiating striæ along the posterior slope, upon the umbonal angle and above. Interior unknown.

Four specimens measure respectively 25, 36, 38 and 39 mm. in length, and 14, 20, 21 and 21 mm. in height. The largest individual observed has a length of 55 mm.

This species somewhat resembles *G. præcursor*, but differs in the comparatively finer concentric folds, smaller anterior end, more cuneate form, less defined umbonal angle and the very oblique cincture.

At some localities specimens are extremely abundant, usually of small size and much distorted from pressure. In all the collections only two or three individuals have been obtained preserving the entire form.

Formation and localities. In the shales of the Hamilton group, in Otsego, Chenango, Madison, Onondaga and Seneca counties, N. Y.

EUTHYDESMA, N. G.

EUTHYDESMA SUBTEXTILE.

PLATE LXIII, FIGS. 11–16; AND PLATE XCIII, FIGS. 28, 29.

Astarte sublextilis, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 245, fig. 6. 1843.
Cardiomorpha subtextilis, HALL. Prelim. Notice Lamellibranchiata, 2, p. 93. 1870.
" " " (*textilis, in error*). Pal. N. Y., vol. v, pt. 1. Plates and Explanations Pl. 63, figs. 11–15. 1883.
" *undulata*, " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, fig. 16. 1883.

SHELL large; body broadly sub-ovate, with a sub-alate cardinal expansion; length one-fifth greater than the height; basal margin very regularly curving to the post-inferior extremity, which is sub-truncate above. Cardinal line rigidly straight. Anterior end short and regularly rounded.

Valves moderately convex in the posterior part, very gibbous in the middle and umbonal region.

Beaks sub-anterior, large, prominent and incurved. Umbonal slope rounded and merging into the general convexity of the shell.

Surface marked by fine, sharp, elevated concentric striæ, which, in well-preserved shells, are crossed by fine, slender, radiating striæ, giving the surface a cancellated appearance. At the intersection of the striæ, minute nodes are formed. In old shells the surface becomes raised into unequal concentric undulations and also into stronger undulations, which cross the lines of growth obliquely on the middle of the shell. Some specimens show two low plications along the post-cardinal slope.

Hinge-line straight and marked by a distinct, continuous ligamental groove. Other characters of the interior unknown.

Two specimens measure respectively 37 and 45 mm. in length, and 30 and 37 mm. in height. The largest specimen observed has a length of about 75 mm.

A careful comparison of this fossil with other species shows it to be so entirely distinct in its form and exterior characters, as well as in the features of the hinge, that there are no allies in our geological formations with which it

can be compared. The specimens, showing the strong oblique folds on the umbonal slope, were separated from the others, and designated as *Cardiomorpha undulata*, as cited above; a farther comparison shows that these are only old individuals of the original species.

Formation and locality. In the Portage group, six miles north-east of Portland Harbor, in Chautauqua county, N. Y.

EDMONDIA, De Koninck. 1844.

Edmondia rhomboidea.

PLATE LXIV, FIGS. 7, 8; AND PLATE XCV, FIGS. 15, 16.

Edmondia rhomboidea (Hall), S. A. Miller. Cat. Am. Pal. Foss., p. 191. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 7, 8. 1883.

Shell small, rhomboid, sub-circular; length a little greater than the height; pallial margin regularly rounded from the two extremities, with the posterior end sometimes sub-truncate. Cardinal line short and straight.

Valves regularly convex below, gibbous in the middle and above.

Beaks at about the anterior third, large and prominent, incurved. Umbonal angle obtuse above, merging into the general convexity of the shell.

The surface of the cast preserves evidences of fine concentric striæ, which are fasciculate on some portions of the shell, and of fine radii which have been principally observed on the anterior half of the shell.

There is a slight fold, indicating a lateral tooth, on the postero-cardinal margin. Other characters of the interior unknown.

The two specimens described measure respectively 22 and 23 mm. in length, and 19 and 21 mm. in height.

This species somewhat resembles *E. Philipi*, but it is usually a more nearly circular and more gibbous form.

Formation and localities. In the sandstones of the Chemung group, at Salamanca, and four miles north of Panama, N. Y.

Edmondia Philipi.

PLATE LXIV, FIGS. 9, 11–14, 17, 29; AND PLATE XCV, FIGS. 1–4.

In part *Edmondia Philipi*, Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 9–18. 1883.
" " *Burlingtonensis* (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " " Pal. N.Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell of medium size or larger, very broadly elliptical; length greater than the height. Pallial margin regularly curving from the extremities. Posterior margin sometimes sub-truncate. Cardinal line straight or gently curving. Anterior end broad and regularly rounded.

Valves moderately convex in the lower and posterior part, becoming gibbous in the middle and above.

Beaks sub-central. Umbonal slope convex, not defined.

Test thin. Surface marked by fine, closely arranged, concentric striæ, which are sometimes raised into slender, lamellose expansions. Specimens in the sandstones often show obscure, broad plications along the pallial margin which do not extend above the middle of the valve, and are not external features of the shell. Interior unknown.

Three specimens measure respectively 29, 32 and 44 mm. in length, and 24, 25 and 38 mm. in height.

This species, in some of its smaller individuals, closely resembles the preceding.

The general form of the shell in the shales is broadly sub-oval, approaching sub-circular; the surface is finely striated concentrically with some gentle undulations of the shell.

The sharp, distant, elevated, lamelliform striæ which mark the surface of some specimens are due to the condition of preservation, the finer striæ having been obliterated.

Formation and localities. In the shales of the Chemung group, at Philipsburgh and Rockville, in the sandstones at Hobbieville, Randolph and Connewango, N. Y., and in the shales and sandstones at Mansfield, Pa.

Edmondia obliqua, n. sp.

PLATE LXIV, FIGS. 15, 23 (16?); AND PLATE XCV, FIGS. 5–8.

In part *Edmondia Philipi*, Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 9–18. 1883.
" " *Burlingtonensis* (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " " Pal. N.Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell of medium size, obliquely sub-rhomboidal; length a little greater than the height; basal margin broadly curving. Posterior extremity sub-truncate, abruptly rounded below. Cardinal line short, straight. Anterior end short, sub-truncate.

Valves of moderate convexity below, somewhat gibbous in the umbonal region.

Beaks sub-anterior, prominent, oblique, rising above the hinge-line and incurved. Umbonal slope prominent, obtusely sub-angular above, and merging into the general convexity before reaching the post-inferior extremity.

Surface marked by fine concentric striæ, which are more or less fasciculate, producing varices of growth.

Four specimens measure respectively 19, 20, 27 and 30 mm. in length, and 16, 19, 22 and 26 mm. in height.

This shell is distinguished by its oblique form and sub-truncate extremities. In some of its phases it more nearly resembles *E. Philipi* than any other, but the beaks are more oblique and more anterior, and the form is not so regularly rounded.

Formation and localities. In the Chemung group, at Rock creek, Hobbieville and Painted Post, N. Y.; and Mansfield, Pa.

Edmondia subovata, n. sp.

PLATE LXIV, FIGS. 18, 19, 20, 26, 27, 28 (10, 21?); AND PLATE XCV, FIGS. 9-12.

In part *Edmondia Philipi*, Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 9–18. 1883.
" " *Burlingtonensis* (White and Whitfield), Hall Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " " Pal. N.Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell from medium to large size, broadly elliptical; length about one-third greater than the height; basal margin gently curving in the middle, more abruptly curving toward either extremity. Posterior margin regularly rounded. Cardinal line nearly straight. Anterior end large, regularly rounded.

Valves regularly convex, somewhat gibbous in the umbonal region.

Beaks at about the anterior third, prominent and incurved over the hinge. Umbonal slope gibbous above, not defined nor affecting the post-inferior margin.

Surface marked by fine, lamellose, concentric striæ, which are unequally fasciculate, sometimes making conspicuous varices of growth.

Three specimens measure respectively 33, 35 and 46.5 mm. in length, and 22, 25 and 31 mm. in height.

This species differs from *E. Philipi* in its broadly elliptical form and more anterior position of the beaks, characters by which it may be readily distinguished.

Formation and localities. In the Chemung group, at Philipsburgh and Hobbieville, N. Y.; and Mansfield, Tioga county, Pa.

Edmondia transversa, n. sp.

PLATE LXIV, FIG. 24.

In part *Edmondia Burlingtonensis* (White and Whitfield), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell of medium size, rhomboid-elliptical; length one-third greater than the height; basal margin straight in the middle, curving gently toward either

extremity. Posterior margin vertically sub-truncate. Cardinal line straight. Anterior end short, abruptly rounded below the lunule.

Valves convex below and posteriorly, gibbous in the middle and umbonal region.

Beaks sub-anterior, rather prominent, rising a little above the hinge-line. Umbonal slope prominent, scarcely defined, but extending to the post-inferior extremity. Post-cardinal slope broad.

Surface marked by fine concentric striæ, which are abruptly recurved over the umbonal slope, and are fascicled, rising into lamellose elevations. Interior unknown.

A specimen has a length of 30 mm. and a height of 21 mm.

This species differs from *E. Philipi* in its rhomboidal form, truncate posterior end, prominent umbonal slope and lamellose concentric striæ.

Formation and localities. In the sandstones of the Chemung group, at Cold Spring, Cattaraugus county, and doubtfully near Olean, N. Y.

Edmondia Burlingtonensis.

PLATE LXIV, FIG. 22; AND PLATE XCV, FIGS. 13, 14.

Edmondia Burlingtonensis, White and Whitfield. Proc. Bost. Soc. Nat Hist., vol. 8, p. 301. 1862.
In part *Edmondia Burlingtonensis* (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 90. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell of medium size, ovate-elliptical; length one-third greater than the height; basal margin straight in the middle, curving into both extremities. Posterior margin regularly rounded. Cardinal line straight. Anterior end short and regularly rounded.

Valves moderately convex below and posteriorly, gibbous in the middle and umbonal region.

Beaks at about the anterior fourth, prominent, incurved. Umbonal slope convex, not defined, merging into the general convexity of the shell before reaching the post-inferior extremity.

Surface marked by fine concentric striæ, which are more or less fasciculate, producing undulations which are more conspicuous on the posterior half of the shell.

The specimen figured has a length of 27 mm. and a height of 18 mm. Another individual has a length of 25 mm. and a height of 17 mm.

As compared with *E. subovata* the beaks are more anterior, the basal margin is less convex, the umbo is narrower, the umbonal slope more prominent and the post-cardinal slope is wider.

In fig. 22 of plate lxiv, the beak is represented as too prominent, giving a disproportionate height to the shell, and the posterior end is too wide.*

Formation and locality. In the Yellow sandstones, at Burlington, Ia.

EDMONDIA DEPRESSA.

PLATE LXIV, FIG. 32

Edmondia depressa, HALL. Prelim. Notice Lamellibranchiata, 2, p. 91. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, fig. 32. 1883.
Edmondia? tapesiformis. MEEK. Pal. Ohio, vol. II, p. 304, pl. 13, fig. 6. 1875.

SHELL large, ovate-elliptical, sub-quadrangular; length more than one-fourth greater than the height; basal margin gently curving to the post-inferior extremity, where it is abruptly recurved and obliquely sub-truncate above. Cardinal line straight, scarcely declining posteriorly. Anterior end short and regularly rounded.

Valves depressed-convex below and posteriorly, and somewhat gibbous above.

Beaks sub-anterior, moderately prominent (much too prominent, as represented in the figure), slightly inclined forward and rising but little above the hinge-line. Umbonal slope regularly rounded.

* The figure of *E. Burlingtonensis*, above cited, was made and lithographed about fifteen years since, under the direction of Mr. R. P. WHITFIELD, from a specimen then in his collection, and may therefore be considered authentic. The other forms identified by him as of the same species, and thus published in the "Preliminary Notice" and "Plates and Explanations," cited above, have, on farther examination, proved to be distinct from that one, and are thus described in this volume. The illustrations on plate xcv will serve to give a more satisfactory expression of the specific characteristics.

Surface marked by regular, coarse concentric striæ, which are sometimes fasciculate, forming low undulations. Interior unknown.

The specimen described has a length of 48 mm. and a height of 35 mm.

This species differs from *E. Philipi* in its more elongate form, sub-anterior beaks, longer hinge-line and coarser and more regular concentric striæ.

The specimen fig. 31, plate lxiv, from the conglomerate, near Olean, was originally referred to this species, but it is apparently distinct, differing in its smaller beaks, sub-angular umbonal ridge and more truncate posterior extremity.

Formation and locality. In the Waverly sandstone, Licking county, O.

Edmondia ellipsis, n. sp.

PLATE LXIV, FIG. 25.

In part *Edmondia Burlingtonensis* (White and Whitfield), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 19–29. 1883.

Shell large, broadly elliptical; length more than one-fourth greater than the height; basal margin regularly curving, and recurved over the posterior end without any abrupt change, and thence to the cardinal line. Cardinal line straight, slightly declining posteriorly. Anterior end short, regularly rounded.

Valves moderately convex in the lower and posterior portions, becoming gibbous above and in the umbonal region.

Beaks sub-anterior, moderately prominent. Umbonal slope convex, not defined.

Surface marked by somewhat fine concentric striæ, which are sometimes elevated and lamellose, curving over the umbonal slope and joining the cardinal line at a very small angle.

The hinge preserves a linear cardinal fold or groove posterior to the beaks. Other characters of the interior unknown.

The specimen described has a length of 43 mm. and a height of 30 mm.

This species differs from *E. Philipi* in its more anterior beaks and longer

hinge-line; and from *E. depressa* in its more gibbous form, narrower posterior end, and more regular curvature of the basal margin into the posterior margin.

Formation and locality. In the Burlington sandstones, at Burlington, Ia.

EDMONDIA? TENUISTRIATA, n. sp.

PLATE LXIII, FIGS. 9, 10; AND PLATE XCV, FIG. 17.

Cardiomorpha suborbicularis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 9, 10. 1883.
Not " " " S. A. MILLER. Cat. Am. Pal. Foss., p. 186. 1877.
Not *Ungulina suborbicularis*, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 243, t. 106, fig. 2. 1843.

SHELL of medium size, sub-orbicular; length a little greater than the height. Pallial margin regularly curved. Cardinal line short and straight.

Valves moderately convex, scarcely gibbous in the umbonal region.

Beaks sub-central, slightly tumid, rising but little above the hinge-line. Umbonal slope undefined.

Surface marked by fine, regular, concentric striæ, which are cancellated by fine radiating striæ; the latter more conspicuous on the posterior slope. Interior unknown.

The specimen described has a length of about 25 mm. and a height of 23 mm.

This species has been compared with and supposed to be identical with *Ungulina suborbicularis*, *loc. cit.*, but it is entirely distinct from that form and from a different horizon. Its generic relations cannot be satisfactorily determined, and it is placed provisionally under the genus EDMONDIA. But two specimens have been observed and are worthy of note on account of their peculiar form and surface characters.

Formation and locality. In the shales of the Chemung group, near Elmira, N. Y.

SPHENOTUS, N. G.

SPHENOTUS TRUNCATUS.

PLATE LXV, FIGS. 1, 4-6.

Cypricardites truncatus, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, pl. 12, fig. 17, p. 244. 1842.
Sanguinolites truncatus (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 42. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, figs. 1-6. 1883.

SHELL small, trapezoidal; length twice the height; basal margin nearly straight, slightly constricted anterior to the middle. Posterior extremity obliquely truncate. Cardinal line straight. Anterior end narrow, rounded.

Valves depressed-convex at the posterior end, moderately convex below, becoming gibbous above the middle.

Beaks at about the anterior fourth or fifth, small, appressed, incurved, rising but little above the hinge-line. Umbonal slope angular, extending to the post-inferior extremity. Post-cardinal slope flat, or concave, with an obscure fold along the middle. A shallow cincture extends from the beak obliquely to the base of the shell.

Surface marked by fine concentric striæ, which are fasciculate on the anterior portion and umbonal region, producing low undulations; also marked by very fine radiating striæ. Interior unknown.

Three specimens measure respectively 10, 15 and 18 mm. in length, and 5, 7 and 9 mm. in height.

This species differs from *S. arcæformis* in its straighter basal margin, less pointed and less obliquely truncate posterior end and in its smaller size.

Formation and localities. In the shales of the Hamilton group, at Summit and Bear's gulf, Schoharie county, and on the shore of Skaneateles lake, N. Y.

Sphenotus arcæformis.

PLATE LXV, FIGS. 7–11; AND PLATE LXVI, FIG. 43?

Sanguinolites arcæformis, Hall. Prelim. Notice Lamellibranchiata, 2, p. 40. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, figs. 7–11. 1883.
" *Æolus*, Hall (in error). Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, fig. 43. 1883.

Shell of medium size, trapezoidal; length usually more than twice the height; basal margin gently curved, sometimes nearly straight in the middle. Posterior extremity obliquely truncate. Cardinal line straight, slightly declining posteriorly. Anterior end short, sloping rapidly from the beak and narrowly rounded below.

Valves becoming gibbous in the middle and umbonal region.

Beaks at about the anterior fourth, small and closely appressed. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope concave, and marked by a scarcely defined fold which is nearer to the umbonal ridge than to the cardinal margin. Most of the specimens show a flattening or undefined depression extending from the beaks to the basal margin.

Surface marked by extremely fine concentric striæ, which sometimes become fasciculate in the anterior portion of the shell, and are undulating on the post-cardinal slope; also by fine radiating striæ, which are rarely well-preserved, and are mainly confined to the posterior half of the shell.

Five specimens measure respectively 23, 28, 32, 26 and 26 mm. in length, and 11, 13, 14, 14 and 11.5 mm. in height.

This species differs from *S. cuneatus* in its smaller size, narrower posterior extremity, more convex basal margin, less conspicuous post-cardinal ridge, and in the surface characters.

Formations and localities. In the shales of the Hamilton group, near Delphi, at Pratt's falls and on the shore of Skaneateles lake, Onondaga county, N. Y.; and doubtfully in the Chemung group near Smethport, Pa.

Sphenotus cuneatus.

PLATE LXV, FIGS. 12-17.

Pterinea cuneata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 116. 1838.
Sanguinolites cuneatus (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 39. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, figs. 12-17. 1883.

Shell large, trapezoidal; length more than twice the height; basal margin constricted anterior to the middle and gently curving to both extremities. Posterior extremity obliquely sub-truncate, sinuate. Cardinal line straight. Anterior end short, rapidly declining from the beak and narrowly rounded below.

Valves depressed-convex posteriorly, moderately convex below the middle and becoming somewhat gibbous in the umbonal region.

Beaks sub-anterior, small, flattened and closely appressed. Umbonal slope marked by an obtusely angular fold or ridge, extending to the post-inferior extremity. Post-cardinal slope concave, marked along its centre by a low fold, which is a little nearer the cardinal line than to the umbonal ridge, extending to the posterior extremity. Cincture oblique, extending from the beak to the base of the shell, producing a depression of the surface and a sinuosity in the margin.

Surface marked by fine concentric striæ, which become fasciculate and often form low undulations anterior to the umbonal ridge; also by fine radiating striæ on the body of the shell, which have not been observed on the post-cardinal slope.

Four specimens measure respectively 33, 42, 42 and 48 mm. in length, and 14, 17, 18 and 19 mm. in height.

This species differs from *S. arcæformis* in its proportionally greater length, with a greater height at the posterior end; in its sinuate posterior margin, constricted basal margin and more regular concentric striæ.

In certain conditions of preservation, the radiating striæ are obscure or obsolete, and sometimes worn by weathering, and are therefore not to be relied upon as characterizing the species in all cases.

The identification with Mr. CONRAD'S species was made from a lithographed figure which has never been published.

Formation and locality. In the shales of the Hamilton group, in Schoharie county, N. Y.

SPHENOTUS SUBTORTUOSUS.

PLATE LXV, FIGS. 18, 19.

Sanguinolites subtortuosus, HALL. Prelim. Notice Lamellibranchiata, 2, p. 41. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, figs. 18, 19. 1883.

SHELL large, robust, trapezoidal; length more than twice the height; basal margin constricted anterior to the middle and gently curving to either extremity. Posterior extremity doubly truncate. Cardinal margin straight or gently arcuate, and very slightly declining posteriorly. Anterior end short, abruptly declining from the beak and narrowly rounded below.

Valves moderately convex posteriorly, becoming gibbous in the middle and umbonal region.

Beaks sub-anterior, attenuate, appressed and incurved, rising but little above the hinge-line. Umbonal slope marked by a low ridge, extending to the post-inferior extremity, becoming undefined below the middle of its length. Post-cardinal slope convex, marked along the middle of its width by a low ridge, extending from the beaks to the posterior extremity, producing an angularity in the margin. Cincture broad, distinct, extending from the beaks and constricting the basal margin a little anterior to the middle.

Surface marked by fine concentric striæ, which in some parts of the shell are fasciculate, producing low undulations of the surface; and also by fine radiating striæ, which are often not well-preserved.

Ligamental area narrow; characters of the interior unknown.

Two specimens measure respectively 50 and 55 mm. in length, and 23 and 26 mm. in height.

This shell resembles the preceding, but is a larger and more robust form, the valves are more gibbous; the umbonal ridge is distinctly arcuate, not so

strongly developed, and becoming obsolete toward the post-inferior extremity; the posterior margin is distinctly doubly truncate, with the lower truncation vertical, and the cincture is more strongly marked.

Formation and localities. In the shales of the Hamilton group, at Fultonham, Schoharie county, and at York, Livingston county, N. Y.

Sphenotus solenoides.

PLATE LXV, FIGS. 21-29.

Sanguinolites solenoides, Hall. Prelim. Notice Lamellibranchiata, 2, p. 38. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 65, figs. 21-29. 1883.

Shell large, trapezoidal; length more than twice the height; basal margin nearly straight, slightly arcuate in the centre, curving toward the anterior end. Posterior extremity obliquely truncate. Cardinal line straight, about half the length of the shell, parallel to the basal line. Anterior end long, gradually declining from below the beaks and narrowly rounded at the extremity.

Valves moderately convex below and posteriorly, becoming somewhat gibbous in the middle and umbonal regions.

Beaks situated about two-fifths of the length of the shell from the anterior end, small, appressed and incurved, rising but little above the hinge-line. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope flat or slightly concave, with an obscure fold along the middle, extending to the posterior extremity. Cincture indistinct, appearing as a flattening or slight depression, extending from the beak to the basal margin anterior to the middle. (This feature is frequently obsolete, except in well-preserved specimens.)

Surface marked by fine concentric striæ, which are fasciculate, producing more or less distinct folds or undulations upon the anterior and middle portions of the shell, and bending abruptly upward on crossing the umbonal ridge. The posterior half of the shell, especially above the umbonal ridge, is further marked by fine, irregular, elevated vascular lines. In some speci-

mens similar markings appear, in a subdued degree, over the anterior portion of the shell. Interior unknown. Ligamental area narrow.

Four specimens measure respectively 28, 33, 38 and 42 mm. in length, and 12, 14, 16 and 16.5 in height. The largest specimen observed has a length of 72 mm. and a height of 28 mm.

This species is distinguished by its long anterior end and peculiar ornamentation on the posterior half of the shell.

Formation and localities. In the shales of the Hamilton group, Sherburne creek near Sherburne, Hamilton, Bellona and on the shores of Canandaigua and Cayuga lakes, N. Y.

Sphenotus contractus.

PLATE LXVI, FIGS. 1, 3-9, 11-13, 15 (10, 16, 17, 19?); AND PLATE XCIV, FIG. 2.

Cypricardia contracta, Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 292, t. 139, fig. 4. 1843.
In part *Sanguinolites rigidus* (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 44. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 1–19. 1883.

Shell ranging from small to large size; trapezoidal, wider behind; length more than twice the height; basal margin nearly straight, scarcely constricted in the middle and gently curving to either extremity. Posterior extremity oblique, somewhat doubly truncate. Cardinal line straight, long, nearly parallel to the basal margin. Anterior end short, abruptly declining from the beak and narrowly rounded below.

Valves of moderate convexity, except in the upper portion and umbonal region, where they are gibbous.

Beaks sub-anterior, small, appressed and closely incurved over the hinge-line. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope flat, marked along its centre by a distinct fold, which reaches to the posterior end, producing an extension of the margin, leaving a more oblique truncation above than below. Cincture without distinct limitation, producing a flattening above and a slight depression below the middle of the valve.

Surface marked by fine, somewhat regular concentric striæ, with obscure indications of radiating striæ upon the middle of the shell. The post-cardinal slope is sometimes marked with fine undulating and bifurcating vascular lines, which become obsolete below the umbonal ridge.

Ligamental area narrow. Hinge marked by two short triangular cardinal teeth in the right valve, and by one or two extremely slender lateral teeth. Anterior muscular impression strongly marked; posterior scar shallow. Pallial line simple, distinctly marked by closely arranged radiating lines extending from above and terminating at the line.

Five specimens measure respectively 29, 31, 32, 37 and 43 mm. in length, and 13, 13, 15, 15 and 19 mm. in height.

This species resembles *S. cuneatus*, but the umbonal ridge is not so strongly marked, the cincture is a much less conspicuous feature, and the posterior end is more pointed.

Formation and localities. In the Chemung group at Philipsburgh and Rockville, Alleghany county; near Olean and Randolph, Cattaraugus county; near Ellington and north of Panama, Chautauqua county, N. Y.; and at Warren and Alleghany springs, Warren county, Pa.

Sphenotus (?) arcuatus, n. sp.

PLATE LXVI, FIG. 18.

In part *Sanguinolites rigidus* (White and Whitfield), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 1–19. 1883.

Shell large, elongate, sub-trapezoidal, arcuate; length more than twice the height; basal margin gently arcuate. Posterior extremity obliquely truncate. Cardinal line long, straight, more than half the length of the shell, parallel to the basal margin. Anterior end short, abruptly rounded below.

Valves becoming gibbous in the middle and umbonal region.

Beaks sub-anterior, appressed, incurved, rising but little above the hinge-line. Umbonal slope obtusely angular, arcuate, declining gently to the middle of the shell and then more abruptly to the post-inferior extremity,

Post-cardinal slope broad. Cincture extending from the beak obliquely to the base, becoming broad below the middle of the shell.

Surface marked by fine concentric striæ, the impressions of which are preserved upon the cast.

Anterior muscular impression deeply marked, limited posteriorly by a ridge, situated just below the beaks. Pallial line continued parallel to the basal margin, recurving over the umbonal ridge and terminating in a large muscular scar on the post-cardinal slope.

The specimen described has a length of 50 mm. and a height of 23 mm.

This species somewhat resembles *S. subtortuosus*, but the umbonal ridge is more arcuate, the cardinal slope is wider and without distinct plication.

Formation and locality. In a conglomerate of the Chemung group, east of Panama, N. Y.

Sphenotus clavulus.

PLATE LXVI, FIGS. 2, 20-26.

Sanguinolites? clavulus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 45. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 20–26. 1883.

Shell of medium or large size, elongate, sub-trapezoidal; length more than two and a half times the height; basal margin nearly straight or slightly arcuate in the middle, curving to the anterior and posterior extremities. Posterior extremity narrowly rounded below and oblique above. Cardinal line straight, slightly declining posteriorly, nearly parallel to the basal margin and extending more than half the length of the shell. Anterior end declining more or less abruptly from the beaks and narrowly rounded below.

Valves moderately convex below, gibbous in the middle, and on the umbonal slope to beyond the middle of its length.

Beaks sub-anterior, small, closely appressed, incurved, and rising very little above the hinge. Umbonal slope sub-angular from the beak to the middle of its length, becoming rounded and less defined below and reaching the post-inferior extremity. Post-cardinal slope moderately convex, with

an obscure fold which may sometimes be obsolete. Cincture scarcely perceptible, sometimes producing a slight constriction in the inferior margin.

Surface marked by fine concentric striæ, which may be more or less fasciculate, producing gentle undulations of the surface. No radiating striæ have been observed.

Ligamental area narrow. Anterior muscular impression strongly marked.

Five specimens measure respectively 29, 31, 46, 48 and 49 mm. in length, and 12, 13, 17, 17 and 18 mm. in height.

The shell is proportionally longer and narrower than any of the preceding species, the form is more arcuate and there is no conspicuous fold on the post-cardinal slope.

Formation and localities. In the Chemung group, at Philipsburgh, and in loose masses of sandstone near Portville and Olean, N. Y.

Sphenotus rigidus.

PLATE LXVI, FIG. 11.

Cypricardia? rigida, White and Whitfield. Proc. Bos. Soc. Nat. Hist., vol. viii, p. 300. 1862.
In part *Sanguinolites rigidus* (White and Whitfield), Hall. Prelim. Notice Lamellibranchiata, 2, p. 44. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 1–19. 1883.

The figure is from the original specimen described.* It differs from *S. contractus* in its more robust, shorter and more rigid form, more obtuse post-inferior extremity, and more nearly vertical lower truncation of the posterior end. The supposed clavicle corresponds with the posterior limit of the anterior muscular impression as shown in fig. 9 of plate lxvi.

Formation and locality. In the Yellow sandstones, at Burlington, Ia.

* The specimens here described as *S. contractus* and *S. arcuatus* were identified by Mr. R. P. Whitfield as belonging to *Sanguinolites rigidus*, White and Whitfield, and thus referred in the Preliminary Notice of the Lamellibranchiata, 2 (above cited), and at the same time were thus arranged on the Plates for the Palæontology of New York, then being lithographed. A careful comparison of specimens with a cast of the original of *S. rigidus* has shown the necessity of separating the Chemung species, and recognizing in one of the forms, the original of *Cypricardia contracta*, published in 1843.

Sphenotus flavius.

PLATE LXVI, FIGS. 27-29.

Sanguinolites? flavius, Hall. Prelim. Notice Lamellibranchiata, 2, p. 47. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 27–29. 1883.

Shell of medium size, elongate, sub-cylindrical; length nearly three times the height in the vertically compressed specimen described; basal margin gently curving, straight or slightly constricted about the middle of its length. Posterior extremity narrowly rounded or sub-acute, obliquely truncate above. Cardinal line straight, nearly parallel to the basal margin. Anterior end short, narrowly and sub-acutely rounded.

Valves moderately convex below and posteriorly, gibbous in the middle and umbonal region.

Beaks sub-anterior, moderately prominent. Umbonal slope rounded, scarcely sub-angular near the beaks, extending to the posterior extremity. Post-cardinal slope with an obscure fold or plication. Cincture oblique, not strongly defined, extending from the beaks to near the middle of the base.

Surface marked by fine concentric striæ of growth, which become fasciculate and form unequal undulations upon the posterior and umbonal portions of the shell; also marked by fine radiating striæ. Interior unknown.

The specimen described has a length of 44 mm. and a height of 14.5 mm.

This species differs from any of the preceding forms in the anterior position of the beaks. The extension of the umbonal slope to the middle of the posterior end, and the gaping of the valves, are due to vertical compression.

Formation and locality. In the Waverly sandstones of Licking county, O.

Sphenotus valvulus.

PLATE LXVI, FIG. 30.

Sanguinolites valvulus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 46. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, fig. 30. 1883.

Shell large, sub-cylindrical, very elongate posteriorly; length less than three times the height; basal margin very gently curving, with a slight constric-

tion near the anterior end. Posterior extremity apparently slightly gaping, narrowly rounded; the greatest extension being in the line of the longitudinal axis. Cardinal line straight, about two-thirds the length of the shell, parallel with the basal margin. Anterior end short, gently declining from the beaks and rounded below.

Valves moderately convex.

Beaks sub-anterior, low, closely appressed. Umbonal slope obscurely marked by two low ridges, one extending to the post-inferior margin and the other to the middle of the posterior end. Post-cardinal slope marked by an obscure fold. Cincture narrow, not strongly defined, extending from the beak to the basal margin at about the anterior third of the length of the shell.

Surface marked by fine concentric striæ, which, from the appearance of the cast, have been fasciculate on the anterior and posterior ends of the shell. No radiating striæ have been observed. Interior unknown.

The specimen described has a length of 49 mm. and a height of 18 mm.

This species is entirely unlike the other forms here described in its elongate hinge-line, gentle convexity of the valves and undefined umbonal ridge.

Formation and locality. In the Waverly sandstones, at Newark, Licking county, O.

Sphenotus Æolus.

PLATE LXVI, FIGS. 31–35.

Sanguinolites Æolus, Hall. Prelim. Notice Lamellibranchiata, 2. p. 46. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 31–35. 1883.

Shell large, elongate-ovate, sub-trapezoidal; length more than twice the height; basal margin gently rounded, sometimes nearly straight. Posterior extremity obliquely sub-truncate. Cardinal line straight, or slightly arching and gently declining posteriorly. Anterior end declining gently from the beaks and abruptly rounded below.

Valves convex below, gibbous in the middle and umbonal region.

Beaks sub-anterior, small, appressed, closely incurved, rising but little

above the hinge-line. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope flat or convex, with an obscure fold along the middle, which may be obsolete in the cast. Cincture not conspicuous, consisting of a slight depression or constriction extending from the beaks obliquely backward to about the middle of the shell.

Surface marked by fine concentric striæ, which become fascicled, producing low undulations, which are usually more conspicuous on the anterior and posterior portions of the shell; also obscurely marked, in the cast, by fine radiating striæ posterior to the cincture. Interior unknown.

Three specimens measure respectively 50, 44 and 37 mm. in length, and 22, 20 and 16 mm. in height.

This species closely resembles *S. rigidus*, but the cincture is more oblique, extending further backward on the basal margin; the post-cardinal slope is narrower and less distinctly marked by a fold along the middle.

Formation and locality. In the Waverly sandstone, at Newark, O.

Sphenotus signatus, n. sp.

PLATE XCIV, FIG. 3.

Shell large, very elongate-elliptical; length nearly three times the height; basal margin gently curving. Posterior extremity doubly truncate, vertical below and oblique above. Cardinal line long, very gently arcuate. Anterior end produced, declining from the beaks and narrowly rounded.

Valves moderately convex along the basal and posterior portions, becoming gibbous in the middle.

Beaks sub-anterior, small, but little elevated above the hinge. Umbonal ridge rounded, scarcely angular, extending to the post-inferior extremity. A sub-angular fold extends along the middle of the post-cardinal slope.

Surface marked by fine concentric striæ, which are distinctly undulated in passing over the umbonal and cardinal ridges.

The specimen described has a length of 55 mm. and a height of 20 mm.

This form is comparatively more elongate than any other species. In its strong post-cardinal fold it may be compared with *S. cuneatus* and *S. subtortuosus* of the Hamilton group, but it has no anterior depression nor sinuosity of the pallial margin. The produced anterior end and regularly curving basal margin are distinguishing characters.

Formation and locality. In the Waverly group, at Warren, Pa.

Sphenotus Telamon, n. sp.

PLATE XCIV, FIG. 1.

Shell large, elongate sub-elliptical; length more than twice the height; basal margin very gently curved. Posterior extremity narrowly rounded below and obliquely truncate above. Cardinal line very slightly arcuate. Anterior end declining from the beaks and somewhat narrowly rounded below.

Valves gently convex in the lower and posterior portions, becoming gibbous in the middle.

Beaks at about the anterior fourth, incurved. Umbonal slope obtusely angular above, extending to the post-inferior margin. Cardinal slope wide, marked along its centre by a distinct fold, which extends to the upper posterior margin.

Surface marked by fine concentric striæ, which on the middle and posterior portions are irregularly fasciculate, forming distinct undulations of the surface; anterior end with regular sub-angular ridges. The striæ at the post-inferior extremity are almost rectangularly recurved.

The specimen described has a length of 59 mm. and a height of 26 mm.

This species in its general external characters resembles Allorisma, but the limitation of the post-cardinal slope by the umbonal angle and the distinct plication along the middle of this area are characteristic features of Sphenotus, and on this account it is placed under that genus.

Formation and locality. In the Chouteau limestone of the lower Carboniferous, in Cooper county, Mo.

SPATHELLA, N. GEN.

SPATHELLA TYPICA.

PLATE LXVI, FIGS. 36-40.

In part *Sanguinolites ventricosus* (WHITE and WHITFIELD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 36–42. 1883.

SHELL of medium or large size, from sub-cylindrical to elongate-ovate, wider behind; length from two and a half to less than twice the height; basal margin gently curved, sometimes nearly straight. Posterior extremity narrowly or broadly rounded. Cardinal line straight, less than half the length of the shell. Anterior end short, narrowly rounded below.

Valves moderately convex posteriorly, gibbous in the middle and umbonal region.

Beaks anterior or sub-anterior, small, closely appressed, rising but little above the hinge-line. Post-umbonal slope rounded or sometimes sub-angular, extending to the post-inferior extremity.

Surface marked by fine concentric striæ, and at somewhat regular intervals by sharp, lamellose striæ. Interior unknown.

Eight specimens measure respectively 46, 46, 45, 43, 38, 35, 32 and 32 mm. in length, and 24, 18, 20, 20, 16, 16, 15 and 14 mm. in height.

This shell evidently belongs to the *Lithophagi*, but is not referable to any known genus. The specimens are extremely variable in proportions, as shown by the measurements, but are usually easily recognized by their sub-cylindrical form and the distant lamellose elevated striæ, which make a regular curve over the posterior portion of the shell, turning forward to the cardinal line. This character of surface somewhat resembles MACRODON, but the absence of radiating striæ and the short cardinal line are distinguishing characters.

Formation and localities. In the Chemung group, near Elmira and Ithaca; in Lindley township, Steuben county, N. Y.; and in Sullivan, Tioga and Bradford counties, Pa.

Spathella ventricosa.

PLATE LXVI, FIGS. 41, 42

Orthonota ventricosa, White and Whitfield. Proc. Bos. Soc. Nat. Hist., vol. viii, p. 297. 1862.
Sanguinolites ventricosus (W. and W.), S. A. Miller. Cat. Am. Pal. Foss., p. 203. 1877.
In part " " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 66, figs. 36–42. 1883.

Shell of medium size, elongate, sub-cylindrical, widest behind; length more than twice the height; basal margin nearly straight, scarcely arcuate in the middle, curving into both extremities. Posterior extremity abruptly rounded. Cardinal line nearly straight, about half the length of the shell, parallel to the basal margin. Anterior end very short, abruptly rounded below.

Valves very convex, gibbous along the middle and in the umbonal region.

Beaks anterior, not prominent, small and closely incurved. Post-umbonal slope rounded, gibbous.

Surface marked by fine concentric striæ, which are fasciculate, or sub-lamellose, upon the umbonal and posterior regions. Interior unknown.

The two specimens described measure respectively 26 and 35 mm. in length, and 12 and 16 mm. in height.

This species resembles the preceding, in many respects, but the anterior end is shorter, the valves are more gibbous in the anterior portion, and the lamelliform striæ are not so strongly marked.

Formation and locality. In the Yellow sandstones, at Burlington, Iowa.

CONOCARDIUM, Bronn. 1835.

Conocardium cuneus.

PLATE LXVII, FIGS 1-32; PLATE LXVIII, FIGS. 1, 4-16; AND PLATE XCIV, FIGS. 11, 12.

Pleurorhynchus cuneus, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 206. 1840.
Conocardium cuneus (Conrad), S. A. Miller. Cat. Am. Pal. Foss., p. 187. 1877.
" " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 67, figs. 21–27, 29–32. 1883.
Pleurorhynchus attenuatus, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 253. 1842.
Conocardium attenuatum (Conrad), S. A. Miller. Cat. Am. Pal. Foss., p. 187. 1877.
" " ? " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 67, figs. 1–11. 1883.
Pleurorhynchus trigonalis, Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 171, t. 67, figs. 6, 6*a*. 1843.
Conocardium trigonale (Hall), S. A. Miller. Cat. Am. Pal. Foss., p. 187. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 67, fig. 28; pl. 68, figs. (1 ?), 4–16. 1883.
Conocardium nasutum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl 67, figs. 12–20. 1883.
Bilobites, De Kay.* Ann. Ly. Nat. Hist. N. Y., vol. i, p. 45, pl. 5, figs. 1–4. 1824.

Shell large, angularly sub-ovate, or trigonal in outline; length less than twice the height; basal margin gently curving from the post-inferior extremity to the anterior end. Posterior extremity abruptly truncate, produced into a tubular extension along the cardinal line. Cardinal line straight, margins inflected toward the anterior end. Anterior end more or less rapidly attenuate, with the margins gaping before reaching the extremity.

Valves gibbous.

Beaks sub-central, vertical, prominent and closely incurved over the hinge-line. Umbonal slope angular, usually strongly defined, extending to the post-inferior extremity. Post-cardinal slope flat or concave.

Test thick, composed of two distinct layers. Surface marked by numerous radiating plications and intermediate arching lamellose, concentric striæ on the body of the shell. The posterior slope is ornamented by curving radii, extending from the beak to the posterior margin, with the interspaces marked by transverse lamellose striæ. From the entire periphery of the umbonal ridge there extends a finely striated expansion of the shell, which increases in extent from the beaks downward, and in old shells is supported anteriorly by a thickening of the shell along the basal margins, which often

* Note on the Organic Remains termed Bilobites, from the Catskill Mountains. By J. E. De Kay, M. D. Read October 13, 1823.

obliterates the radii. At the junction of these thickened portions, along the base of the valves, the shell is excavated, leaving a tubular opening extending backward from the post-inferior extremity, as shown in figs. 27, 29 and 52 of plate lxvii, and more fully in fig. 12 of plate xciv.

Valves crenulated along their margins. Anterior muscular impressions elongate, deeply impressed, narrower behind.

Four specimens measure respectively 60, 47, 43 and 21 mm. in length, and 30, 33, 26 and 13 mm. in height.

This species resembles *C. normale*, in the Hamilton group, but that form is usually more elongate with uniform simple ribs, and the interradial spaces are marked by fine radiating striæ.

The specimens here referred to a single species are subject to great variation in form and general aspect. The main differences are indicated in the following varietal designations:

Var. attenuatum, Conrad. Pl. 67, figs. 1–11. The specimens referred to this form are apparently the young of *C. cuneus*, preserving numerous uniform, fine radii upon the surface and the posterior extremity not abruptly truncated. Specimens having these characters, as they become larger, show a duplication of the radii and gradually assume the character of *C. cuneus*.

Var. trigonale, Hall. Pl. 67, fig. 28; pl. 68, figs. 1, 4–16; pl. 94, fig. 11. This name is given to the specimens occurring in the Corniferous limestone and originally described as a distinct species.

Var. nasutum, Hall. Pl. 67, figs. 12–20. This name is applied to short, triangular forms, which are broad and abruptly truncated behind, abruptly contracted in front, with the anterior end nasute. The body of the shell is marked by fewer radii than in characteristic forms of *C. cuneus*.

Formations and localities. In the Schoharie grit, at Schoharie, and the Helderberg mountains, and on the outcrop of the same formation in the neighborhood of Rondout, Ulster county, and in Orange county, N. Y.; in the Corniferous limestone, at Williamsville, N. Y.; at Dublin and Columbus, Ohio; and at the falls of the Ohio river. It also occurs at Cayuga and other places in Canada West.

The species, in its varieties of form, occurs at Pendleton, Indiana, in a sandstone which probably represents the horizon of the Schoharie grit.

Conocardium Ohioense.

PLATE LXVIII, FIGS. 2, 3.

Conocardium Ohioense, Meek. Proc. Acad. Nat. Sci., Phila., p. 9. 1871.
" " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 2, 3. 1883.

Shell small, ovate, sub-trigonal, ventricose behind the middle of its length; length one-third greater than the height. Posterior end prominent, produced in the middle and sloping abruptly to the post-cardinal angle. Anterior end abruptly contracted in front of the middle and prolonged, nasute, with the extremity narrowly rounded.

The body of the shell is marked by about six strong radiating plications on the ventricose portion of the valve, and on each side by more numerous and smaller plications. The interspaces between the ribs are marked by lamellose concentric striæ.

A specimen of this species has a length of 15 mm. and a height of 10 mm.

This species differs from *C. cuneus* in being more narrowly ventricose, and the body of the shell marked by fewer plications, with a distinct constriction in front; the umbonal slope is more rounded and less oblique, while the posterior extremity is more produced than in the usual forms of *C. cuneus* and *C. trigonale.*

Formation and localities. In the Corniferous limestone, near Columbus, Ohio, and at the falls of the Ohio river.

Conocardium normale.

PLATE LXVIII, FIGS. 17-19.

Conocardium normale, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 17–19. 1883.

Shell large, sub-ovate, trigonal; length about twice the height; basal margin regularly curving. Posterior extremity obliquely truncate. Cardinal line straight. Anterior end narrow, nasute.

Valves ventricose, abruptly contracted anteriorly and truncate behind.

Beaks posterior to the center, prominent, strongly incurved. Umbonal

slope angular, continuing to the post-inferior margin. Post-cardinal slope concave.

Test thick, body of the shell marked by numerous radii, between which are undulating lamellose concentric striæ. When the shell is exfoliated the radii become stronger and the intermediate surface is marked by fine radiating striæ. With the growth of the shell the anterior rays become greatly strengthened and semi-tubular.

The cast of the foot-sheath is bilobed, and doubly pointed behind.

Two specimens measure respectively 50 and 60 mm. in length, 25 and 32 mm. in height, and 26 and 30 mm. in the depth of both valves.

This species bears a close resemblance to the elongate forms of *C. cuneus*. There is, however, no tendency to a duplication of the ribs, which is a common feature in the specimens from the Schoharie grit.

Formation and locality. In the shales of the Hamilton group, near Cumberland, Md.

Conocardium Eboraceum.

PLATE LXVIII, FIGS. 20-23.

Conocardium Eboraceum, Hall. Thirteenth Rep. N. Y. State Cab. Nat. Hist., p. 91. 1860.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 20–23. 1883.

Shell small, sub-ovate; length less than twice the height; basal margin gently curving. Posterior end obliquely truncate. Anterior end abruptly contracted, nasute, gaping.

Valves ventricose in the middle.

Beaks a little anterior to the middle, incurved. Umbonal slope angular, and just within the cardinal slope the shell is marked by five or six angular radiating ribs. The central portion of the post-cardinal slope is unknown.

Test thick. Body and anterior portion of the shell marked by obscure plications and by strong, concentric, reflexed lamellose striæ. The radii are continued beyond the concentric laminæ at the margin, as strong interlocking denticulations.

In well-preserved specimens the concentric laminæ from the umbonal

angle to the anterior end are very strong and elevated, obscuring the radii. Interior unknown.

All the specimens known are much distorted by pressure, and the entire characters cannot be determined.

One specimen has a length of 19 mm. and a height of 9 mm. A large specimen measures 25 mm. in length.

Formation and locality. In the shales of the Hamilton group, at York, Livingston county, N. Y.

CONOCARDIUM DENTICULATUM.

PLATE LXVIII, FIGS. 24, 25.

Conocardium denticulatum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 24, 25. 1883.

SHELL small, ovate-cuneate; basal margin straight. Body gibbous, truncate behind, abruptly contracted and attenuate in front.

Body of the shell marked by five or six strong angular radii; those of the post-cardinal slope unknown. The anterior end is cancellated by fine radii and lamellose concentric striæ. The interspaces between the strong radii are marked by fine concentric striæ. Anterior portion of the shell gaping, the margins of the valves furnished with distant lamelliform denticulations. Interior unknown.

The fragment described has a length of 10 mm. and a height of about 5 mm.

This form differs from *C. Eboraceum* in the strong angular radii upon the body of the shell; the post-cardinal area is smaller and the anterior portion more contracted and attenuate, with much finer radiating and concentric striæ.

Formation and locality. In the shales of the Hamilton group, at York, Livingston county, N. Y.

Conocardium concinnum.

PLATE LXVIII, FIGS. 26, 27.

Conocardium concinnum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 26, 27. 1883.

Shell small, ovate-cuneate, gradually attenuate anteriorly. Posterior end obliquely truncate along the umbonal angle. Post-cardinal slope slightly concave and projecting at the junction of the valves. Valves marked by numerous radii. Body of the shell, to near the anterior extremity, marked by strong sub-equal radii, as preserved in the cast of the interior.

This species is not very different in appearance from *C. attenuatum*, but the ribs are coarser.

Formation and localities. In the calcareous layers of the Hamilton group, at Pratt's falls, Onondaga county, N. Y.; and in the arenaceous beds of the same group, from an unknown locality.

Conocardium liratum.

PLATE LXVIII, FIGS. 28, 29.

Conocardium liratum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 28, 29. 1883.

Shell small, trigonal; length less than twice the height. Posterior slope very broad, marked by about five sharp, distant, elevated plications. Anterior part of the body abruptly contracted and marked by about twelve or more finer plications. The entire surface is also marked by fine lamellose concentric striæ. Interior unknown.

A specimen has a length of 11 mm. and a height of 6 mm.

In general form this species resembles *C. denticulatum*, but is readily distinguished by the strong plications on the anterior portion.

Formation and locality. In the Chemung group, Ithaca, N. Y.

Conocardium reliquum.

PLATE LXVIII, FIG. 33.

Conocardium reliquum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, fig. 33. 1883.

The specimen is the impression of the posterior end, marked by fine radii. The original specimen is not accessible for description. A cast from the original is recorded as coming from the Chemung group. Locality unknown.

Conocardium tegulum.

PLATE LXVIII, FIGS. 30, 31.

Conocardium tegulum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, figs. 30, 31. 1883.

The original specimen is not accessible for description. The figures illustrate all that is known regarding its characters. The specimen is recorded as from the Niagara group. Locality unknown.

Conocardium inceptum.

PLATE LXVIII, FIG. 32.

Conocardium inceptum, Hall. Pal. N. Y., vol. iii, p. 491. 1859.
" *rugosum*, " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 68, fig. 32. 1883.

Shell small, sub-ovate. Body of the shell gibbous or ventricose, marked by six or seven strong rounded plications. Posterior extremity truncate, its special characters unknown. Anterior end short, gaping; inner margin marked by a few strong denticulations. Surface of the anterior portion cancellated by fine radiating and concentric striæ, the latter extending over the strong plications and marking the interspaces.

In the general surface characters it is very similar to *C. denticulatum*, but the anterior end is comparatively shorter and more abruptly contracted at the extremity; the ribs on the body of the shell are more rounded.

The specimen described has a length of 20 mm.

Formation and locality. In the shaly limestone of the Lower Helderberg group, Albany county, N. Y.

PANENKA, BARRANDE. 1881.

PANENKA DICHOTOMA.

PLATE LXX, FIG. 21; AND PLATE XCIV, FIG. 13.

Cardiola? dichotoma, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, fig. 21. 1883.

SHELL large, obliquely ovate; length a little greater than the height. Pallial margin curving very regularly from the anterior to the post-inferior extremity and then more abruptly returning to the hinge-line. Anterior end short; posterior end more extended.

Valves of moderate convexity in the lower portion, becoming gibbous in the middle and above.

Hinge-line short and straight.

Beaks prominent, strongly incurved, turning distinctly forward.

Surface marked by numerous prominent, radiating plications, which frequently bifurcate. Interior unknown.

Two specimens measure respectively 65 and 70 mm. in length, and 65 and 67 mm. in height.

This species bears considerable resemblance to *P. robusta* of the Portage group, and was formerly recognized as the same, but the beaks are more prominent than in that species, the radii are more closely arranged and frequently bifurcating, while in that one they are essentially simple.

Formation and localities. In the Schoharie grit in Albany and Schoharie counties, N. Y.

PANENKA ALTERNATA, n. sp.

SHELL very large, broadly ovate; length a little greater than the height. Anterior end short.

Valves moderately convex, becoming gibbous in the umbonal region.

Hinge-line short. Ligamental area narrow, visible beneath and posterior to the beak.

Beaks strong, incurved, turning slightly forward.

Test marked by numerous sub-angular radii; on the umbo, each third or fourth one being stronger than the others, becoming equal and rounded below.

The specimen described has a length of about 110 mm. and a height of 97 mm.

This species is distinguished by its large size, moderate convexity and the alternation of the radii in the umbonal region.

Formation and locality. In the Corniferous limestone, near Columbus, Ohio.

Panenka multiradiata, n. sp.

PLATE LXIX, FIG. 5; AND PLATE XCIV, FIG. 18.

In part *Cardiola radians* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 5–11. 1883.

Shell large, sub-circular or broadly ovate; length greater than the height. Pallial margin regularly rounded from the anterior to the middle of the posterior end, whence it is a little more abruptly curving to the post-cardinal extremity. Anterior end short and regularly rounded. Posterior end expanded.

Valves regularly convex below, becoming gibbous or ventricose in the middle and above.

Hinge-line short, straight. Ligamental area short and high.

Test thin. Surface marked by numerous, closely arranged, flattened or convex radii.

The specimen described has a length of 65 mm. and a height of 57 mm.

Formation and locality. In the limestone of the Upper Helderberg group, at Clarence Hollow, Erie county, N. Y.

Panenka ventricosa.

PLATE LXIX, FIGS. 1, 2.

Cardiola? elevata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 1, 2. 1883.
Not *Monotis elevata*, Conrad. Proc. Acad. Nat. Sci., Phila., vol. iii, p. 23. 1846.

Shell of medium size or larger, sub-circular; length greater than the height. Pallial margin regularly curving. Anterior end large.

Valves regularly convex below the middle, becoming ventricose above.

Hinge-line straight. Ligamental area short and high.

Beaks sub-central, elevated, prominent and incurved.

Surface marked by very numerous fine and closely arranged flattened radii, and by very fine concentric striæ. Interior unknown.

The specimen described has a length of 48 mm. and a height of 42 mm.

This species is distinguished by its extreme ventricosity of the valves, prominent beaks and finely radiated surface.

Formation and locality. In the Goniatite limestone of the Marcellus shale, Schoharie county, N. Y.

Panenka Hero.

PLATE LXIX, FIG. 3.

Cardiola? Hero, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, fig. 3. 1883.

Shell small, sub-circular; length a little greater than the height. Pallial margin regularly rounded.

Valves moderately convex.

Hinge-line short. Ligamental area narrow.

Beaks sub-central, small, pointed and incurved.

Surface marked by strong rounded or sub-angular plications, some of which are duplicate. The plications are direct on the anterior portion of the shell and curving on the posterior. Interradial spaces about equal in width to the radii. Entire surface also marked by fine undulating concentric striæ. Interior unknown.

One specimen has a length of 32 mm. and a height of 29 mm.

This species differs from any other in the strong elevated distant radii, and in its small pointed beaks.

Formation and localities. In the Marcellus shale, on the Indian Reservation, near Buffalo, and in the same horizon near West Avon, N. Y.

Panenka equilatera.

PLATE LXIX, FIG. 4 (7 ?); AND PLATE XCIV, FIG. 17.

Cardiola? equitatera, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, fig. 4. 1883.

Shell of medium size, sub-circular; length a little greater than the height. Pallial margin regularly rounded.

Valves convex below, gibbous in the middle and above.

Hinge-line short. Ligamental area well-defined, not high.

Beaks sub-central, elevated, turning forward, incurved.

Surface marked by from forty to fifty simple strong radii with equal interspaces; radii rarely bifurcating. Also marked by fine, close, concentric striæ.

Two specimens measure respectively 34 and 35 mm. in length, and 30 and 31 mm. in height.

This species has about the same size and proportions as *P. Hero*, but the ribs are much more numerous and not so strongly elevated.

Formations and localities. In the Marcellus shales at Avon; and in the Hamilton group at Pratt's falls, Onondaga county, N. Y., and doubtfully from Cumberland, Md.

Panenka costata, n. sp.

PLATE XCIV, FIG. 15.

Shell large, broad-ovate; length about one-fifth greater than the height. Pallial margin regularly rounded in front and on the base, expanding behind.

Valves very ventricose in the middle.

Hinge-line short.

Beaks sub-central, prominent, incurved.

Surface concentrically striated, and marked by strong rounded or somewhat flattened costæ with narrower interspaces. The radii curve distinctly forward on the anterior portion of the shell. Interior unknown.

One specimen has a length of 51 mm. and a height of 42 mm.

This species differs from *P. Hero* in the more numerous, more rounded and more closely arranged radii.

Formation and locality. In a limestone of the Marcellus shale, Stafford, Genesee county, N. Y.

Panenka Lincklæni.

PLATE LXIX, FIGS. 12-14.

Cardiola Lincklæni (Hall), S. A. Miller. Cat. Am. Pal. Foss., p. 186. 1877.
" ? " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 12-14. 1883.

Shell large, sub-orbicular or broadly ovate; length about one-fourth greater than the height. Pallial margin regularly curving, somewhat flattened along the base and extended posteriorly.

Valves moderately convex below, gibbous in the middle and above. The specimens usually occur in the soft shale and are extremely flattened.

Hinge-line short.

Beaks sub-central, elevated, directed forward and incurved.

Surface concentrically striated and marked by about thirty, broad, flattened, radiating plications, with sometimes intermediate smaller ones, which arise upon the umbo and continue to the basal margin. The intermediate radii are sometimes confined to the anterior and posterior portion of the shell, but often occupy the entire disc.

Three specimens measure respectively 63, 84 and 96 mm. in length, and 52, 63 and 73 mm. in height.

This species is distinguished for its large size, and broad, flattened radii.

Formation and localities. In the Marcellus shale, Flint creek, near Phelps, Ontario county, the Indian Reservation near Buffalo, and at Avon, N. Y.

Panenka mollis, n. sp.

PLATE LXXX, FIGS. 8 (9?).

Cardiola? ——, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 80, fig. 8. 1883.

Shell of medium size, broadly obovate, length and height nearly equal. Pallial margin regularly rounded, a little truncate on the posterior slope.

Valves moderately convex below, gibbous in the middle and above.

Beaks prominent, attenuate.

Surface marked by fine, undulating concentric striæ and by about forty-five rounded radii, with narrow interspaces. Some of the radii become less conspicuous and duplicate upon the posterior slope.

The specimen described has a length, in its compressed condition, of about 28 mm. and a height of 31 mm.

In form this species is similar to *P. retusa*, but the shell is less oblique, the posterior slope longer and the radii are more direct.

Formation and locality. In the Marcellus shale; precise locality unknown.

Panenka retusa, n. sp.

PLATE LXIX, FIG. 6.

In part *Cardiola? radians* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 5–11. 1883.

Shell of medium size, obovate, oblique; length nearly equal to the height. Pallial margin regularly curving.

Valves moderately convex below and in the middle, becoming gibbous in the umbonal region.

Hinge-line short, straight. Ligamental area distinct.

Beaks sub-central, small, curving forward, not prominent.

Surface concentrically striated, and marked by about thirty-five moderately rounded, curving plications, with somewhat narrower interspaces.

The specimen described has a length of 30 mm. and a height of 31 mm.

This species is distinguished by its broad obovate form, its sub-equal length and height, and by its regular curving simple plications.

Formation and locality. In the shales of the Hamilton group on the shore of Cayuga lake, N. Y.

Panenka potens, n. sp.

PLATE LXIX, FIGS. 8, 10.

In part *Cardiola? radians* (Conrad). Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 5–11. 1883.

Shell large, obliquely broad-ovate; anterior end expanded; length greater than the height. Pallial margin regularly curving along the posterior end, a little truncate on the base and more narrowly rounded in front.

Valves moderately convex below, becoming gibbous or ventricose in the middle and above.

Hinge-line one-third the length of the shell. Ligamental area long and narrow.

Beaks large, prominent and incurved over the hinge-line.

Surface concentrically striated and marked by from thirty-five to forty rounded, rarely duplicate plications, with narrower or sub-equal interspaces.

A specimen has a length of 80 mm. and height of 64 mm.

This species differs from *P. radians* in its more ovate, less nearly equilateral form, and in the more simple radii.

Formation and localities. In the shales of the Hamilton group at Cazenovia and other localities in Madison county, N. Y.

Panenka radians.

PLATE LXIX, FIG 9.

Pterinea radians, Conrad. Jour. Acad. Nat. Sci. Phila., p. 252. Pl. 15, fig. 1. 1842.
Monotis radians (Conrad), S. A. Miller. Cat. Am. Pal. Foss., p. 196. 1877.
Cardiola radians (Hall), S. A. Miller. Cat. Am. Pal. Foss., p. 186. 1877.
In part *Cardiola? radians* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1 Plates and Explanations: Pl. 69, figs. 5–11. 1883.

Shell large, broadly ovate or sub-circular; length greater than the height. Pallial margin regularly curving, broader anteriorly.

Valves moderately convex in the lower portion, becoming gibbous in the umbonal region.

Ligamental area narrow.

Beaks sub-central, moderately prominent and incurving over the hinge-line.

Surface marked by fine, closely arranged, undulating concentric striæ, and by from forty to forty-five rounded or somewhat flattened radii, which are frequently duplicating on the anterior and posterior slopes. Interspaces narrower than the plications.

A specimen has a length of 55 mm. and a height of about 42 mm. The original figure given by Mr. CONRAD has a length of 65 mm. and a height of 51 mm., and is a good representation of the species.

In form this species more nearly resembles *P. Lincklæni* than any other, but the plications are much more numerous. It differs from *P. potens* in its more rotund form and in the duplication and outward curvature of the plications on the anterior portion of the valve.

Formation and localities. In the coarser shales of the Hamilton group at Cazenovia, and at Pratt's falls, N. Y.

PANENKA ABRUPTA, n. sp.

PLATE LXIX, FIG. 11; AND PLATE XCIV, FIG. 16.

In part *Cardiola? radians* (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 69, figs. 5–11. 1883.

SHELL of medium size, obovate, broadest below, rapidly tapering above the middle; length and height nearly equal in the cast. Pallial margin regularly curving from the posterior along the basal margin, and somewhat straighter upon the posterior slope.

Valves gibbous in the middle and above.

Ligamental area distinct with an oblique fold under the beak.

Beaks sub-central, abruptly attenuate, elevated.

Surface marked by concentric striæ and by about thirty radii; those upon the body of the shell being strong, sub-angular and wider than the interspaces. The plications sometimes show a tendency to bifurcation and interstitial addition.

Two specimens measure respectively 35 and 40 mm. in length, and 35 and 38 mm. in height.

In form this species somewhat resembles *P. equilatera*, but the beaks are more abruptly attenuate, and the radii are much stronger and more prominent, with comparatively wider interspaces.

Formation and locality. In the shales of the Hamilton group, near Cumberland, Md.

Panenka degener, n. sp.

PLATE XCIV, FIG. 14.

Shell of medium size, broadly obovate; length and height nearly equal. Pallial margin regularly curving, somewhat obliquely truncate on the posterior side.

Valves regularly convex, scarcely gibbous.

Beaks prominent, elevated and strongly incurved.

Surface marked by extremely fine, closely arranged concentric striæ, and by about forty-five narrow angular radii, which are less defined on the posterior slope. Interspaces wider than the radii.

The specimen described has a length of about 40 mm.

This species is distinguished by its narrow, sharp, abruptly elevated radii.

Formation and locality. In the shales of the Hamilton group, at Pratt's falls, Onondaga county, N. Y.

Panenka robusta.

PLATE LXX, FIGS. 22-24.

In part *Cardiopsis robusta* (Hall), S. A. Miller. Cat. Am. Pal. Foss., p. 186. 1877.
Cardiola? robusta, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 22-24. 1883.

Shell large, obliquely obovate; length somewhat greater than the height. Pallial margin vertical to the hinge-line in front, thence more regularly curving around the base to the posterior extremity. Post-inferior extremity extended.

Valves moderately convex below, becoming gibbous in the upper and umbonal regions.

Beaks at about the anterior third, prominent and incurved.

Surface marked by closely arranged, undulating, concentric striæ, and by about forty strong elevated sub-angular radii, which are narrower than the interspaces. Several of the rays on the posterior slope are bifurcating.

The two specimens described measure respectively 62 and 63 mm. in length, and 57 and 60 mm. in height.

This species resembles *P. dichotoma* (which is not well represented in fig. 21, plate lxx), but is distinguished by its more elevated and more angular plications, a few of which only are bifurcate on the posterior slope, while in that species they frequently bifurcate or trifurcate.

Formation and locality. In the Portage group, in the Genesee valley, below Portage, N. Y.

In the Proceedings of the Academy of Natural Sciences of Philadelphia, vol. iii, 1846, p. 23, Mr. CONRAD has described two species referable to the genus PANENKA. They were described under the genus MONOTIS, and the previously described species, *Pterinea radians*, was there referred by Mr. CONRAD to the same genus. *Panenka radians* (*Pterinea radians*, CONRAD), coming from the Hamilton shales, in the State of New York, has been recognized and is described and illustrated in the present volume, *vide ante.*

The following are the original descriptions as given by Mr. CONRAD:

Panenka Poulsoni (*Monotis Poulsoni*, CONRAD).

"Sub-orbicular, ventricose, not oblique, ribs about 44 in number, obtusely rounded, interstices nearly flat, about as wide as the ribs, with minute transverse wrinkles; umbo broad and the summit prominent; anterior and posterior margins rounded.

"*Locality.* Jersey shore, Lycoming county, Pennsylvania. (Devonian shale.)

"This beautiful species occurs in a dark shale of the same geological age and appearance as the shale of the Chemung Narrows in New York, which is a part of the Devonian System."

Panenka elevata (*Monotis elevata*, CONRAD).

"Obliquely oval, somewhat ventricose, ribs about 42 in number, prominent, acutely rounded, interstices very narrow, except towards the anterior hinge margin, where the ribs are larger; anterior and posterior margins nearly straight; anterior side very short.

"*Locality.* Occurs with the preceding species in the same rock."

GLYPTOCARDIA, N. G.

GLYPTOCARDIA SPECIOSA.

PLATE LXX, FIGS. 2-9; AND PLATE LXXX, FIG. 10.

Avicula speciosa, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 243, t. 106, figs. 1, 1*a*. 1843.
Cardiola speciosa (HALL), S. A. MILLER. Cat. Am. Pal. Foss., p. 186. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 2-9. 1883.
Compare *Venericardium retrostriatum*, v. BUCH. Ueb. Ammon, p. 50. 1832.
" *Cardiola retrostriata* (v. BUCH), KEYSERLING. Petschora-Land, p. 254, pl. 11, figs. 3-3*c*. 1846.
" " " " SANDBERGER. Verstein. Nassau, p. 270, pl. 28, figs. 8, 9, 10. 1850-1856.
" " ? " " var. *Bohemica*, BARRANDE. Syst. Sil. Bohême, pl. 181, fig. II, 1-10. 1881.
" *Cardium retrostriatum*, " GEINITZ. Grauwackenform. in Sachsen, II, s. 47, taf. 12, fig. 7.
" " *palmatum*, GOLDFUSS. Petref. Germ., p. 217, t. 143, fig. 7. 1837.
" " " " F. A. RŒMER. In Dunker and Von Meyer, Palæontographica, Bd. III, s. 26*f*, taf. 4, figs. 11, 12. 1850.

SHELL small, broadly elliptical or sub-circular, sometimes broadly obovate; length about one-fourth greater than the height; basal margin regularly curving, somewhat obliquely truncate from the beak to the posterior extremity.

Valves regularly convex below, becoming gibbous in the middle and descending thence to the beaks.

Beaks anterior to the middle, closely incurved and directed forward.

Surface marked by from twelve to fifteen plications; those on the body of the shell broad, flattened along their upper surface and sculptured by prominent arching lamellose striae, which are sometimes raised into nodes. The interspaces are finely, and inconspicuously, transversely striated.

Numerous specimens measure 7 mm. in length and 5 mm. in height. The smallest specimen observed has a length of 3.5 mm. and a height of 2.5 mm. The largest individual in the collection has a length of 10 mm.

The specimens are subject to considerable variation in form, chiefly owing to the direction of the pressure from the enclosing matrix. The plications also vary in width and prominence, and in the degree of sculpturing.

This species has a wide range in New York, occurring in the Hamilton group, Genesee slate, Portage and Chemung groups. It is probably identical

with the *Cardiola retrostriata* (VON BUCH) of various authors, and with *Cardium palmatum* of GOLDFUSS. Its citation by numerous authors shows its wide distribution in Europe.

Formations and localities. In the shales of the Hamilton group near Geneva, Ontario county; Sherburne creek, Chenango county, and on the shores of Cayuga lake. In the Genesee slate at Bristol, Ontario county, and numerous other localities. In the Portage group at Branchport, Yates county; and at Ithaca, Tompkins county, N. Y.

PRÆCARDIUM, BARRANDE. 1881.

PRÆCARDIUM VETUSTUM.

PLATE LXX, FIGS. 18-20.

Cardium? vetustum, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 245, t. 107, fig. 2. 1843.
Cardiola vetusta (HALL), S. A. MILLER. Cat. Am. Pal. Foss., p. 186. 1877.
Prœcardium vetustum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 18–20. 1883.
Compare " *despectum*, BARRANDE. Syst. Silur. de Bohême, vol. vi, pl. 285, III, figs. 5–8. 1881.

SHELL small, trigonal, arcuate, oblique; length greater than the height. Anterior margin concave, becoming rounded below; basal margin gently curved. Posterior margin contracted below, and obliquely truncate above.

Valves moderately convex below, becoming gibbous in the umbonal region. Hinge-line declining posteriorly.

Beaks anterior, prominent and strongly incurved.

Surface marked by fine concentric striæ and by from ten to fourteen strong elevated flattened radii, which show a tendency to duplication on the anterior end. Interspaces flat, as wide or wider than the radii.

Three specimens measure respectively 17, 17 and 16.5 mm. in length, and 14, 10.5 and 13 mm. in height.

This is a smaller species, but very similar to *Prœcardium despectum*, of BARRANDE, *loc. cit.*

Formation and locality. In the shales of the Portage group on the shore of lake Erie, near Portland Harbor, N. Y.

PARACARDIUM, Barrande. 1881.

Paracardium Doris.

PLATE LXX, FIGS. 10, 11.

Cardiola Doris, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 10, 11. 1883.

Shell minute, broadly ovate; length and height nearly equal. Pallial margin regularly curving, except on the posterior slope, which is sub-truncate.

Valves gibbous in the middle and above.

Beaks anterior to the centre, prominent, incurved.

Surface marked by numerous fine radii, with narrow interspaces.

A specimen has a length of 3.5 mm. and a height of 4 mm.

This form is similar to several species of the genus illustrated by Barrande. The figures given on plate lxx do not properly represent the form of the species.

Formation and locality. In the soft shales of the Portage group, at Shakers' Mill, Cashaqua creek, N. Y.

PARARCA, N. G.

[Types *P. transversa, P. venusta, P. Sao* and *P. erecta.*]

PARARCA PRÆCEDENS.

PLATE XCIV, FIG. 19.

SHELL of medium size, broad-ovate, narrowing posteriorly; length one fourth greater than the height; basal margin regularly curving. Posterior extremity rounded. Cardinal line straight and apparently slightly declining posteriorly. Anterior end declining rapidly from the beak and regularly rounded below.

Valves moderately convex below, becoming gibbous in the middle and above.

Beaks at about the anterior third, prominent. Post-umbonal slope prominent, extending to the posterior extremity.

Surface marked by numerous, fine rounded radii, with narrow interspaces.

The specimen described has a length of 31 mm. and a height of 24 mm.

This species differs from *P. neglecta* in its larger size, more elevated beak and finer striæ; the radii upon the anterior slope are notably much finer than in that species. The species is described from a gutta-percha impression of the natural mould.

Formation and locality. In the cherty layers of the Corniferous limestone, in Cayuga, Canada West.

PARARCA TRANSVERSA.

PLATE LXX, FIGS. 12, 14, 15.

In part *Cardiola transversa*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 12–15. 1883.

SHELL small, oblong, sub-elliptical; length about one-third greater than the height; basal margin regularly and gently curving. Posterior extremity broadly rounded or somewhat obliquely sub-truncate. Cardinal line straight,

more than half the length of the shell. Anterior end short, declining from the beaks and regularly rounded in front.

Valves regularly convex below, gibbous in the middle and upper portion.

Beaks at about the anterior third, prominent, directed forward and incurved. Post-umbonal slope gibbous, defined and extending to the post-inferior extremity.

Surface marked by numerous fine radii, which are somewhat stronger on the anterior end, and by fine concentric striæ.

Anterior muscular impression well-marked, situated just below the lunule.

Three specimens measure respectively 22, 24 and 25 mm. in length, and 15, 15 and 16 mm. in height.

This species somewhat resembles *P. Sao*, but it has a smaller shell, with much finer and more numerous radii, which are direct, and not arched as in that species.

Formation and locality. In the sandstone of the Chemung group near Salamanca, N. Y., and at Alleghany springs, Warren county, Pa.

Pararca Sao.

PLATE LXX, FIG. 17.

Cardiola Sao, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, fig. 17. 1883.

Shell large, broadly elliptical; length less than one-third greater than the height; basal margin regularly curving. Posterior extremity obliquely subtruncate. Cardinal line slightly arcuate. Anterior end short and regularly rounded below the lunule.

Valves regularly convex below, becoming gibbous in the middle and in the umbonal region.

Beaks sub-anterior, moderately prominent, incurved. Umbonal slope convex, not strongly defined, extending in an arching direction to the post-basal extremity.

Surface marked by numerous strong, rounded plications. Those on the antero-basal margin are much stronger than those on the posterior half of

the shell. Interspaces narrower than the radii. All the plications, except those of the anterior end, are arcuate, corresponding essentially with the direction of the umbonal slope. Entire surface marked by fine concentric striæ of growth.

Two specimens measure respectively 45 and 50 mm. in length, and 32 and 37 mm. in height.

In form this species somewhat resembles *P. transversa*, but it has a much larger shell, the radii are coarser and the umbonal slope not nearly so abrupt.

Formation and localities. In the Chemung group at Meadville, associated with *Spirifera Verneuili*, and also near Uniontown, Pa.

Pararca venusta, n. sp.

PLATE XCIV, FIG. 22.

Shell large, broadly elliptical; length less than one-third greater than the height; basal margin regularly and gently curving. Posterior extremity broadly rounded. Cardinal line short, slightly arcuate. Anterior end short, regularly rounded below the lunule.

Valves regularly convex in the lower and posterior part, gibbous in the middle and above.

Beaks sub-anterior, not prominent. Umbonal slope not defined, the line of greatest convexity arcuate and continuing from the beak to the post-inferior extremity.

Surface marked by numerous fine rounded radii, with narrower interspaces, the radii of the anterior end being stronger as they approach the margin of the shell; crossed by fine concentric lamellose striæ, which, toward the margins, become fasciculate and produce stronger varices of growth.

Two specimens measure respectively 39 and 43 mm. in length, and 31 and 32 mm. in height.

This species resembles *P. Sao*, in general form, but is proportionally narrower posteriorly, and marked by much finer radii.

Formation and localities. In the upper part of the Chemung group, at Warren, Pa.; and at Panama, N. Y., above the conglomerate.

Pararca neglecta, n. sp.

PLATE LXX, FIG. 13.

In part *Cardiola transversa*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, figs. 12–15. 1883.

Shell small, broadly sub-elliptical; length one-third greater than the height; basal margin regularly curved. Posterior extremity broadly rounded. Cardinal line straight, about half the length of the shell. Anterior end short, regularly rounded below the lunule.

Valves depressed-convex below, becoming moderately convex in the umbonal region, somewhat flattened in the middle below the centre.

Beaks at about the anterior third, low, rounded, rising but little above the hinge-line. Umbonal slope undefined.

Surface marked by numerous fine rounded radii, which are much stronger on the anterior end. Interspaces much narrower than the radii. Entire surface also marked by strong, regular, undulating concentric lamellose striæ.

The specimen described has a length of 23 mm. and a height of 16 mm.

This species is distinguished from *P. transversa* by its broader and less gibbous form, coarser radii, coarser and regular concentric striæ, and undefined umbonal slope.

Formation and locality. In the sandstones of the Waverly group, at Meadville, Pa.

Pararca erecta.

PLATE LXX, FIG. 16; and PLATE XCIV, FIGS. 20, 21.

Cardiola erecta, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, fig. 16. 1883.

Shell of medium size or larger, sub-rhomboidal; length and height nearly equal; basal margin rounded, abruptly recurving at the post-inferior extremity. Posterior extremity gently rounded or nearly vertically sub-truncate. Cardinal line short, less than half the length of the shell. Anterior end short, margin nearly vertical, gently curving to the basal margin.

Valves regularly convex below the middle, becoming gibbous above, somewhat depressed-convex, along the middle, from the umbo to the basal margin.

Beaks at about the anterior third, prominent. Umbonal slope sub-angular above, declining very abruptly to the post-inferior extremity.

Surface marked by numerous fine rounded radii, with narrower interspaces. The radii on the posterior slope are slightly stronger, and those on the anterior are much stronger than those in the middle of the valve. Entire surface marked by strong concentric undulating striæ, which become fasciculate, and produce varices of growth below the middle of the shell.

Ligamental area narrow. Hinge-line with numerous crenulations.

Two specimens measure respectively 29 and 38 mm. in length, and 27 and 36 mm. in height.

This species is distinguished by its erect rhomboidal form, and nearly equal length and height. The radii are also finer than in *P. venusta.*

Formation and localities. In the sandstones of the Waverly group, at Warren and Meadville, Pa.

CARDIOPSIS, Meek and Worthen. 1861.

Cardiopsis radiata.

PLATE LXX, FIG. 25.

Cardiomorpha radiata, Meek and Worthen. Proc. Acad. Nat. Sci., Phila., p. 448. 1860.
Cardiopsis " " Pal. Ills., vol. ii, p. 157, pl. 14, figs. 6*a*, 6*b*. 1866.
" " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 70, fig. 25. 1883.
Megambonia Lyoni, Hall. Thirteenth Rep. N. Y. State Cab. Nat. Hist., p. 110. 1860.

The specimen figured is from the original locality, and is the type referred to in the description of *Megambonia Lyoni.* It does not appear to be congeneric with any of the forms occurring in the New York series.

The species has much resemblance to *Cardiomorpha ovata*, Hall=*Dexiobia ovata*, Winchell.*

Formation and locality. In the Kinderhook group at Rockford, Ind.

* *Dualina*, Barrande, 1881, is apparently identical with *Dexiobia*, Winchell, 1863.

LUNULICARDIUM, MUNSTER. 1840.

LUNULICARDIUM FRAGILE.

PLATE LXXI, FIGS. 1-14.

Avicula fragilis, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 222, t. 94, figs. 1, 2. 1842.
Aviculopecten fragilis (HALL), S. A. MILLER. Cat. Am. Pal. Foss., p. 184. 1877.
Lunulicardium fragile, HALL. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, figs. 1-14. 1883.

SHELL small, short, obovate, and more or less variable in form; abruptly attenuate above; length a little greater than the height; basal and anterior margins regularly rounded. Posterior side obliquely truncate and margined by a thin expansion of the shell.

Valves, in their natural condition, moderately convex in the lower part, and a little gibbous in the umbonal region, but usually much compressed where occurring in the soft shales.

Beaks attenuate, erect.

Surface marked by fine concentric striæ, and in well-preserved specimens by extremely fine radiating striæ, which are sometimes more strongly marked on the posterior portion of the shell.

Three specimens measure respectively 8, 10 and 12 mm. in length, and 8, 9 and 11 mm. in height.

The shells are small and fragile, and usually occur in great numbers in certain layers of the Marcellus shale and Genesee slate. These fossils are usually deprived of the thin expansion bordering the hiatus on the posterior side, the presence of which is shown in figs. 4, 8, 13 and 14 of plate lxxi.

Formations and localities. Common to the Marcellus shale, Hamilton group, Genesee slate and Portage group; also found sparingly in the Chemung group, N. Y. It has likewise been noticed in the Genesee slate of Ohio and Indiana.

Lunulicardium Marcellense.

PLATE LXXI, FIGS. 15, 16.

Cypricardites Marcellensis, Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 147, t. 35, fig. 4. 1842.
Lunulicardium Marcellense, " Hall. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71 figs. 15, 16. 1883.

Shell of medium size, somewhat obovate, truncate behind; length a little greater than the height. Anterior and basal margins regularly curved. Posterior slope obliquely truncate.

Valves moderately convex below, becoming gibbous in the upper portion. Beaks anterior to the middle of the length, erect.

Test of moderate thickness. Surface marked by fine, closely arranged concentric striæ. In exfoliated specimens there are indications of radii which are often more distinctly marked along the margin of the valve.

Three specimens measure respectively 30, 35 and 36 mm. in length, and 32, 33 and 33 mm. in height.

This form differs somewhat from the figure given by Mr. Vanuxem, and a specimen corresponding, in form, to his figure, shows a few distinct plications upon the upper anterior margin of the shell. The material in hand is very unsatisfactory, and better collections may lead to a separation into two distinct species.

Formation and localities. In the Marcellus shale of Cherry Valley, Sharon Springs and Schoharie, N. Y.

Lunulicardium rude.

PLATE LXXI, FIG. 17.

Lunulicardium rude, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, fig. 17. 1883.

Shell of medium size, obovate, obliquely truncate on one side; length and height nearly equal. Anterior and basal margins regularly curving. Postcardinal slope obliquely truncate; margin thickened and deflected.

Valves moderately convex, a little gibbous in the umbonal region.

Beaks anterior to the middle, prominent, inclined forward.

Surface, in the cast, marked by about sixteen or eighteen strong rounded plications, several of which bifurcate toward the margin. There are a few irregular varices of growth indicating the aggregation of the concentric striæ and giving a slightly nodose character to the radii.

One specimen has a length of 30 mm. and a height of 29 mm.

This species resembles *L. curtum*, but the radii are stronger and bifurcate.

Formation and localities. In the Goniatite limestone of the Marcellus shales, at Cherry Valley and Schoharie, N. Y.

Lunulicardium orbiculare, n. sp.

PLATE LXXI, FIG. 24.

Lunulicardium ornatum? Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, fig. 24. 1883.

Shell of medium size, sub-orbicular; length and height about equal. Pallial margin regularly curving. Post-cardinal slope obliquely truncate.

Valves moderately convex, scarcely gibbous above.

Beaks sub-central, slightly inclined forward.

Surface marked by about thirty low rounded plications, which become a little obscure on the upper anterior margin; interspaces narrower than the radii. Also marked by fine undulating concentric striæ.

The specimen described has a length and height of about 26 mm.

This species resembles, in its surface characters, *L. ornatum*, but the shell is shorter, the posterior truncation also shorter, the radii proportionally larger and rounded, and the beak is less attenuate.

Formation and locality. In the Marcellus shale, Bloomfield, Ontario county, N. Y.

LUNULICARDIUM CURTUM.

PLATE LXXI, FIGS. 18-23.

Lunulicardium curtum, HALL. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, figs. 18–23. 1883.

SHELL below the medium size, ovate, sub-trigonal; length usually a little less than the height. Anterior and basal margins regularly curving. Entire length of the posterior side truncate, with a narrow alation along the margin.

Valves, in well-preserved specimens, regularly convex below, becoming gibbous in the middle and above.

Beaks anterior to the middle, prominent, incurved and directed forward.

Surface marked by from twenty-five to thirty regular, narrow, rounded or sub-angular plications, with wider interspaces, and by fine lamellose concentric striæ, which arch upward on the plications. Some specimens show a pustulose character of the surface as indicated in fig. 23 of plate lxxi.

Three specimens measure respectively 13, 20 and 23 mm. in length, and 14, 18 and 24 mm. in height.

This species differs from *L. rude* in its greater height, larger number of plications and more delicate characters. As compared with *L. ornatum*, it has a proportionally much longer posterior truncation, and fewer and narrower plications.

Formations and localities. In the Marcellus shale at Alden, Erie county, N. Y., and in the Hamilton shales on the shores of Cayuga and Seneca lakes, and at Pratt's falls, Tully and Hamburg, N. Y.

LUNULICARDIUM ORNATUM.

PLATE LXXI, FIGS. 25-32.

Pinnopsis ornatus, HALL. Geol. Surv. N. Y., Rep. Fourth Dist., p. 244, t. 186, fig. 8. 1843.
Lunulicardium ornatum, HALL. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, figs. 25–29. 1883.
Pinnopsis acutirostra, " Geol. Surv. N. Y., Rep. Fourth Dist., p. 244, t. 106, fig. 7. 1843.
Lunulicardium acutirostrum, HALL. Prelim. Notice Lamellibranchiata, 2, p 97. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 71, figs. 30–32.

SHELL large, broadly obovate, truncate upon the posterior side. Anterior and basal margins regularly rounded, recurving abruptly at the posterior.

Valves regularly convex below, becoming gibbous in the middle and above.

Beaks anterior to the middle of the length, attenuate, slightly directed forward.

Surface marked by from forty-five to sixty regular, flattened plications, with narrower interspaces; crossed by closely arranged, undulating, lamellose concentric striæ.

Three specimens have lengths of 42, 45 and 55 mm. and are of nearly equal heights respectively.

This species differs entirely from any of the preceding forms, except *L. orbiculare*, from which it is distinguished by a longer truncation upon the posterior side, and by more numerous and flattened plications.

The typical specimen is of nearly equal length and height, and is marked by about sixty flattened plications which are not quite properly represented in fig. 28 of plate lxxi. The prevailing number of rays is from forty to fifty.

The typical specimen of *L. acutirostrum* has the anterior and posterior margins abruptly infolded, giving the shell a much narrower aspect than when in its natural condition. The plications are more slender than in the prevailing forms referred to *L. ornatum*, and from the infolding of the margin those of the anterior end are invisible in the figure. The specimen figure 31, subsequently referred to the same species, has a greater proportional height than the prevailing forms of *L. ornatum*, the plications are also narrower and with narrower interspaces. A comparison of these forms with larger collections, showing numerous intermediate phases, makes it impossible to draw lines of specific distinction, and it is doubtful if any fixed varietal form exists.

Formations and localities. In the shales of the Portage group at Cashaqua creek, Livingston county, and in the arenaceous shales of the Chemung group, at Elmira, N. Y.

Lunulicardium transversum, n. sp.

PLATE XCIV, FIGS. 24, 25.

Shell above the medium size, sub-cylindrical; length more than twice the height; basal margin gently curving. Posterior extremity narrowly rounded. Cardinal line essentially straight, declining posteriorly. Hiatus elongate, more than half the length of the shell; margin defined, but with no exterior expansion preserved. Anterior end short, narrowly rounded.

Valves very convex in the middle and above; the convexity declining gradually toward the posterior end and abruptly toward the base and anterior.

Beaks sub-anterior, small, acute and directed forward. Umbonal slope convex, not strongly defined, extending to the posterior extremity above the middle of its height.

Surface marked by about forty narrow rays, which are flattened or rounded on the middle of the shell, and sub-angular on the anterior and posterior ends. Entire surface also marked by closely arranged, lamellose concentric striæ, which are often aggregated and at intervals produce sub-imbricating lamellæ.

The specimen described has a length of 45 mm. and a height of 20 mm.

This species is distinguished by its elongate and sub-cylindrical form. The specimen described is somewhat vertically compressed so that the height given is less than that of the shell in its natural condition.

Formation and locality. In the Chemung group, at Elmira, N. Y.

PARACYCLAS, Hall. 1843.

[Type *P. elliptica.*]

Paracyclas elliptica.

PLATE LXXII, FIGS. 23-33; AND PLATE XCV, FIG. 18.

Paracyclas elliptica, Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 171, t 67, fig. 2. 1843.
" " " Pal N. Y., vol. v, pt. I Plates and Explanations: Pl. 72, figs. 23-30. 1883.
Lucina (Paracyclas) elliptica, var. *occidentalis*, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 189. 1872.

Shell large, sub-circular or broadly sub-elliptical (subject to great variation in form from compression); length and height about equal. Pallial margin regularly curving from the extremities of the hinge. Cardinal line short, more than one-third the length of the shell, slightly arcuate.

Valves regularly convex, somewhat regularly gibbous in the middle.

Beaks a little anterior to the middle, small, appressed and closely incurved, rising but little above the hinge-line. Umbonal slope defined above by a depression extending from the beaks to about the middle of the posterior extremity, distinctly limiting the post-cardinal slope of the valves.

Test thin. Surface marked by fine concentric striæ, which are aggregated into fascicles at irregular distances.

Ligamental groove narrow and elongate. Posterior muscular impression just within the post-cardinal margin and below the ligamental groove. Pallial line parallel with the basal margin, marked in the cast by a row of elongate nodes, which are the terminations of low ridges from above. Interpallial area pustulose on the cast.

Five specimens measure respectively 30, 32, 40, 44 and 48 mm. in length, and 29, 33, 37, 40 and 44 mm. in height.

This species has been generally identified with *Lucina proavia*, Goldfuss (Petref. Germ., pl. 146, fig. 6, p. 226), but the hinge of that species is much more declining, and the anterior end is more elevated and sub-auriculate, as shown in his figures, which are not features in the American form.

The suggestion of the variety *occidentalis* came from specimens occurring in western localities, preserving the shell with all its exterior markings, in which condition it has not been found in the Corniferous limestones of New York nor in Ohio, so far as observed. A comparison of a large number of specimens, in all conditions of preservation, indicates no differences of character which are of varietal importance.

Formations and localities. In the Corniferous limestone of Western New York, Canada West, Michigan and Ohio; also in the limestone of the age of the Hamilton group at the falls of the Ohio, and Clarke county, Ind.

Paracyclas lirata.

PLATE LXXII, FIGS. 2–19; AND PLATE XCV, FIG. 19.

Posidonia lirata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 116, pl. [no number], fig. 12. 1838.
Lucina (Paracyclas) lirata (Conrad), Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 200. 1872.
In part *Paracyclas lirata* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, figs. 1–19. 1883.

Shell of medium size, sub-circular or broadly elliptical; length a little greater than the height; margins regularly rounded. Cardinal line short, less than half the length of the shell.

Valves moderately convex below, becoming gibbous on the middle and above.

Beaks anterior to the centre, small, appressed, rising but little above the hinge-line. Post-cardinal slope not defined.

Surface marked by fine concentric striæ, and by strong sub-angular concentric ridges, which are more or less sharply defined, depending upon the condition of the specimen and the nature of the matrix in which the fossil is imbedded.

Ligamental grooves distinctly marked and only moderately divergent from the cardinal margin.

Four specimens measure respectively 15, 19, 25 and 28 mm. in length, and 13, 18, 22 and 25.5 in height.

In form, this shell is very like the preceding, but uniformly smaller in size and marked by more or less distinct, angular concentric ridges. The variation of form, and surface characters, is illustrated in the figures cited on plate lxxii.

It also resembles *Lucina lineata*, Goldfuss (Pet. Germ., p. 226, pl. 146, fig. 8), from the Devonian of the Eifel, and may not be specifically distinct.

Formations and localities. Very abundant in the shales of the Hamilton group, in the eastern and central parts of New York, and in the cherty layers above the Hydraulic beds at the falls of the Ohio, and in Clarke county, Ind.

Paracyclas Ohioensis.

PLATE LXXII, FIG. 1; AND PLATE XCV, FIG. 24.

Lucina (*Paracyclas*) *Ohioensis*, Meek. Proc. Acad. Nat. Sci., Phila., p. 6. 1871.
" " " " Pal. Ohio, vol. ii, p. 199, pl. 18, figs. 7*a*, *b*. 1873.
In part *Paracyclas lirata* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, figs. 1–19.

This species is a smaller and more delicate form than *P. lirata*, and with much finer concentric striæ; the anterior end is more produced and flattened than in either of the preceding species, and the posterior depression, caused by the ligamental groove, is more oblique and more decidedly marked on the exterior of the shell.

The posterior extension, as shown by Mr. Meek, is exaggerated in the original figures, giving the aspect of an appendage or extension on the posterior side, while it is only that part of the post-cardinal slope above the ligamental groove. Fig. 7*b* (*loc. cit.*) well represents the form of the species. A comparison of several specimens of this species, with a large collection of *P. lirata*, shows it to be a very distinct form.

Formation and localities. The original specimens were derived from Dublin, Ohio. The specimens which have come under our observation are from cherty beds above the Corniferous limestone at the falls of the Ohio and in Clarke county, Ind.

Paracyclas tenuis.

PLATE LXXII, FIGS. 20–22; AND PLATE XCV, FIG. 25.

Paracyclas tenuis, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, figs. 20–22. 1883.

Shell small, sub-circular; length and height about equal; margins regularly curving. Cardinal line short.

Valves moderately convex.

Beaks a little anterior to the middle, small, closely appressed, scarcely rising above the hinge-line. Post-cardinal slope curved and rapidly declining backward, limited by the ligamental groove, which is very distinctly marked.

Test extremely thin. Surface marked by very fine concentric striæ, which are sometimes aggregated into fascicles toward the pallial margin.

Four specimens measure respectively 7, 8, 9 and 10 mm. in length, and 7.5, 7, 8, 5 and 9 mm. in height.

This species is distinguished by its small size, and very finely striated surface, without distinct undulations.

Formation and localities. In the shales of the Hamilton group on the shores of Skaneateles, Cayuga and Seneca lakes, N. Y.

Paracyclas Chemungensis, n. sp.

PLATE XCV, FIG. 23.

Shell large, sub-orbicular, erect; length and height nearly equal; margins regularly rounded. Cardinal line short.

Valves depressed-convex below and convex above.

Beaks sub-central, rather prominent. Umbonal depression very oblique to the cardinal line.

Surface marked by comparatively even, thread-like striæ, which are somewhat fasciculate on the lower and posterior portions of the shell.

One specimen has a length of 30 mm. and a height of 29 mm.

This species has the size and form of *P. elliptica*, but differs in its more prominent beaks and more regular concentric striæ.

Formation and localities. In the Chemung group at Mansfield, Pa., and doubtfully at Philipsburgh, N. Y.

Paracyclas ignota.

PLATE LXXII, FIG. 34.

Paracyclas ignota, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, fig. 34. 1883.

Shell large, obliquely sub-circular, or very broadly sub-ovate; margins regularly curved, slightly produced in front.

Valves of moderate convexity.

Beaks sub-central, somewhat prominent, rising a little above the hinge-line. Umbonal depression obscure.

Surface, in the cast, marked by fine concentric striæ, which have been somewhat fasciculate.

The specimen described has a length of 41 mm. and a height of 38 mm.

This species differs from *P. Chemungensis* in being a larger form, with less prominent beaks, and with the shell more extended in the upper part. It also differs from *P. rotunda* in its less prominent beaks, less marked umbonal furrow, and in the upper anterior extension and obliquity of the body of the shell.

Formation and locality. In the Chemung group, Meadville, Pa.

Paracyclas rotunda.

PLATE LXIII, FIGS. 18, 19; AND PLATE XCV, FIG. 21.

In part *Cardiomorpha rotunda*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 17–20. 1883.

Shell large, sub-orbicular, or very broadly sub-ovate; length a little greater than the height. Anterior and basal margins regularly curving. Posterior end sub-truncate.

Valves regularly convex below, becoming gibbous in the middle and above.

Beaks sub-central, prominent, rising above the hinge-line. Umbonal furrow oblique, broad and strongly marked.

Surface marked by fine concentric striæ, which are sometimes fasciculate, as shown on the cast of the interior.

A specimen has a length of 48 mm. and a height of 43 mm.

This species is distinguished by its large size, prominent beaks, and broad defined umbonal furrow.

Formation and localities. In the sandstones of the Chemung group, at Kirkwood, Broome county, and Lindley township, Steuben county, N. Y.

Paracyclas erecta, n. sp.

PLATE XCV, FIG. 22.

Shell of medium size, rhomboid, sub-elliptical; height one-fifth greater than the length. Anterior margin regularly curving, from the beaks to the post-basal extremity, which is slightly produced. Posterior margin vertical. Cardinal line short.

Valves moderately convex below, becoming somewhat gibbous in the umbonal region.

Beaks sub-central, small, but little elevated above the hinge. Umbonal slope obtusely sub-angular, extending to the post-inferior extremity.

Surface marked by fine concentric striæ which, toward the anterior and basal margins, are fasciculate.

The cardinal margin, in the cast, is marked by two slender ligamental grooves, diverging from behind the beak.

A specimen has a length of 20 mm. and height of 25 mm.

This species is unlike any other in its erect form, vertical posterior margin and defined umbonal ridge. The umbonal ridge gives the fossil the aspect of Schizodus, but the shell is more delicate than in the species of that genus, the hinge is shorter, the beaks small and appressed, and the diverging grooves, along the cardinal line are similar to Paracyclas.

Formation and localities. In the upper members of the Chemung group, at Warren, Pa.

PARACYCLAS? PAUPER.

PLATE LXXV, FIGS. 24-26; AND PLATE XCV, FIG. 20.

Cytherodon (Schizodus) pauper, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 24-26. 1883.

SHELL small, sub-orbicular; height nearly equal to the length. Margin regularly curving from the distinct lunule to the post-inferior extremity, whence it abruptly curves to the post-cardinal extremity. Cardinal line short.

Valves moderately convex below, gibbous in the middle and above.

Beaks at about the anterior third, somewhat prominent and arching forward. Umbonal slope rounded, not strongly defined.

Surface marked by fine concentric striæ, which are partially preserved in the cast.

Three specimens measure respectively 15, 20 and 22 mm. in length, and 14, 18 and 20 mm. in height.

The general aspect and form of the shell appear to ally this species with PARACYCLAS, but its absolute relations are undetermined.

Formation and locality. In the sandstone of the Chemung group, at Portville, N. Y.

SCHIZODUS, KING. 1844.

SCHIZODUS? FISSA.

PLATE LXXII, FIGS. 35-41.

Paracyclas? fissa, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, figs. 35, 36. 1883.
" *elevata*, " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 72, figs. 37-41. 1883.

SHELL of medium size or larger, obliquely sub-ovate, or sub-trigonal; length greater than the height; basal margin regularly rounded. Posterior extremity narrowly rounded below, and gently curving toward the beak. Cardinal line short, about half the length of the shell. Anterior end short, regularly rounded.

Valves regularly convex below, gibbous in the middle and above.

Beaks in advance of the anterior third, large, acute, prominent and but little incurved in the cast. Umbonal slope arcuate, marked by a slight depression.

Surface of the cast marked by fine concentric striæ.

This species carries a distinct lunule and a deeply marked escutcheon. The anterior muscular impression is very strongly marked, situated close to the anterior margin, immediately below the lunule. Posterior scar large, shallow, situated on the post-cardinal slope, near the extremity. The cast is distinctly marked by a groove, extending from the beaks obliquely backward more than half way to the base in well-preserved specimens, and is much more strongly marked on the beaks and upper part of the valve.

Three specimens measure respectively 31, 34 and 40 mm. in length, and 28, 29 and 34.5 mm. in height.

This species is referred with doubt to the genus SCHIZODUS, since we have no means of ascertaining the characters of the hinge. As compared with the species of that genus, in the succeeding formations, it differs in the arcuation of the cardinal line, and the narrow and rounded post-cardinal slope. A further examination of the specimens shows that those heretofore recognized as two species should be united under a single name.

Formation and locality. In the Schoharie grit, at Schoharie, N. Y.

Schizodus tumidus.

PLATE LXXV, FIGS. 1, 2.

Schizodus tumidus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 94. 1870.
Cytherodon " " Twenty-third Rep. N. Y. State Mus. Nat. Hist. Expl. Pl. 14, fig. 19. 1872 (title page, in error, 1873).
Cytherodon (Schizodus) tumidus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 1, 2. 1883.

Shell of medium size, rhomboid-ovate; length about one-fourth greater than the height. Basal margin regularly rounded anteriorly, produced a little in the middle and sub-truncate behind. Posterior margin obliquely truncate. Cardinal line short, straight. Anterior end short and regularly rounded.

Valves convex below, gibbous in the middle and above.

Beaks at about the anterior third or fourth, prominent, rising considerably above the hinge-line. Umbonal slope sub-angular, bending downward in the middle and continuing to the posterior extremity, producing a nasute extension.

Surface characters unknown.

Muscular impression strongly marked. Pallial line distinct.

The specimen described is a cast of the interior, having a length of 40 mm. and a height of 30 mm.

This species resembles *S. appressa* in general form, but the umbonal angle is less sharply defined in the cast, the beaks are larger, and the posterior muscular impression is much stronger and nearer to the beaks.

Formation and locality. In the limestone of the Upper Helderberg group, near Columbus, Ohio.

SCHIZODUS APPRESSUS.

PLATE LXXV, FIGS. 3-9.

Nuculites appressa, CONRAD. Jour. Acad. Nat. Sci. Phila., vol. viii, p. 248, pl. 15, fig. 4. 1842?
Schizodus appressus (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 95. 1870.
Cytherodon " " " Twenty-third Rep. N. Y. State Mus. Nat. Hist. Expl. pl. 14, fig. 20. 1872.
" (*Schizodus*) *appressus* (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 3–9. 1883.
Schizodus Cayuga, HALL. Prelim. Notice Lamellibranchiata, 2, p. 95. 1870.

SHELL of medium or large size, sub-rhomboid-ovate; length one-sixth to one-fourth greater than the height; basal margin regularly rounded, with a slight constriction or truncation of the margin near the posterior end. Posterior extremity obliquely truncate. Cardinal line slightly arcuate, less than half the length of the shell. Anterior end short, broadly rounded into the basal margin.

Valves moderately convex below, becoming somewhat gibbous in the middle and above.

Beaks at about the anterior third or fourth, moderately prominent, rising but little above the hinge. Umbonal slope sub-angular, distinct, extending to the post-inferior extremity which is often somewhat nasute.

Surface marked by fine concentric striæ, which are aggregated into fascicles on the lower and posterior parts of the shell.

Muscular impressions and pallial line distinctly marked. Valves marked, on the interior, by two narrow furrows along the umbonal slope, showing as two ridges in the cast. Left valve with a single strong, divided cardinal tooth, and a strong posterior lateral tooth which is grooved along its summit.

Five specimens measure respectively 22, 28, 32, 36 and 42 mm. in length, and 18, 23, 25, 26 and 29 mm. in height.

This species is very similar in form to *S. tumidus*, but is less gibbous, the beaks are less prominent and the posterior muscular impression is farther behind the beak. *S. tumidus* is founded upon a single cast of the interior, and, therefore a full comparison cannot be made.

The name *S. Cayuga* was given to a specimen sloping more abruptly along the cardinal line, with the basal margin a little emarginate just anterior to the post-inferior angle, which is distinctly nasute. These features are only a greater development of characters belonging to typical forms of *S. appressus*.

Formation and localities. In the Hamilton group, on the shores of Seneca and Cayuga lakes; at Pratt's falls, Onondaga county; and Summit, Schoharie county, N. Y.

Schizodus ellipticus.

PLATE LXXV, FIGS. 13-15.

Schizodus ellipticus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 96. 1870.
Cytherodon (Schizodus) ellipticus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 13–15. 1883.

Shell small, sub-elliptical; length one-fourth greater than the height; basal margin regularly curving. Posterior extremity obliquely or sometimes almost vertically truncate. Cardinal line short. Anterior end broadly rounded.

Valves depressed-convex below, convex in the middle and above.

Beaks behind the anterior third, small, appressed, rising very little above the hinge-line. Umbonal slope obtusely angular, extending to the post-inferior extremity.

Surface marked by fine, somewhat regular concentric striæ. Interior unknown.

Two specimens measure respectively 15 and 24 mm. in length, and 12 and 16.5 mm. in height.

This species differs from *S. appressus* in its more elliptical form, longer anterior end, and the post-inferior extremity is less produced.

Formation and locality. In the soft shales of the Hamilton group, on the shore of Canandaigua lake, N. Y.

Schizodus contractus, n. sp.

PLATE LXXV, FIGS. 27, 28.

In part *Cytherodon* (*Schizodus*) *cuneus*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 27–30. 1883.

Shell small, ovate-cuneate; length one-third greater than the height; basal margin regularly curving. Posterior extremity pointed, nasute below, obliquely truncate above. Cardinal line more than half the length of the shell. Anterior end short, regularly rounded.

Valves regularly convex below, gibbous in the middle and above.

Beaks at about the anterior third, prominent, incurved, flattened. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope concave, marked by a narrow depression near the cardinal line.

Surface marked by fine, elevated, sharp, filiform concentric striæ, which become fasciculate toward the margin; also sometimes marked by very fine radiating striæ.

Anterior muscular impression strongly limited posteriorly.

Two specimens measure respectively 14 and 15 mm. in length, and 9 and 10 mm. in height.

This species resembles *S. cuneus*, of the Waverly sandstone, but is proportionally longer, the umbonal angle is sharper, the cardinal slope is broader and the basal margin is more broadly rounded.

This shell has the general aspect of a Nucula, but the contraction of the posterior end and the umbonal angle, indicate its relations with Schizodus.

Formation and locality. In the Hamilton group, near the top of the formation, on the shore of Cayuga lake, N. Y.

Schizodus gregarius.

PLATE LXXV, FIGS. 16-18; AND PLATE XCV, FIG. 27.

Schizodus gregarius, Hall. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
Cytherodon (Schizodus) gregarius, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 16–18. 1883.

Shell small, sub-rhomboid-ovate, sometimes sub-cuneate from compression; length from one-fourth to one-third greater than the height; basal margin regularly and broadly curving. Posterior extremity somewhat pointed below and obliquely sub-truncate above. Cardinal line short, less than half the length of the shell. Anterior end short, broadly rounded.

Valves moderately convex below, becoming somewhat gibbous in the middle and above.

Beaks at about the anterior third, small, rising little above the hinge-line. Umbonal slope obtusely sub-angular, continuing to the post-inferior extremity.

Surface marked by fine concentric striæ.

Two specimens measure respectively 12 and 15 mm. in length, and 9 and 12 mm. in height.

This species is similar in form to young individuals of *S. appressus*, but is proportionally longer. It is also smaller and proportionally longer than specimens of *S. rhombeus*.

Formation and locality. Abundant in some chocolate-colored, sandy shales of the Chemung group, on the banks of the Tioga river, near Covington, Pa.

Schizodus rhombeus.

PLATE LXXV, FIGS. 19-23.

Cypricardia? rhombea, Hall. Geol. Surv. N. Y., Rep. Fourth Dist., p. 291, t. 139, figs. 2, 3. 1843.
Schizodus rhombeus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
Cytherodon (Schizodus) rhombeus, Hall. Pal N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 19–23. 1883.

Shell below the medium size, sub-rhomboidal; length a little greater than the height; margins regularly rounded from the anterior end to the post-inferior extremity. Posterior extremity truncate. Cardinal line short.

Valves moderately convex below, and gibbous in the middle and above.

Beaks in advance of the anterior third, prominent, rising considerably above the hinge-line, and incurved. Umbonal slope distinctly angular, extending to the post-inferior extremity.

Surface marked by fine concentric striæ, which are scarcely preserved in the cast.

Two specimens measure respectively 18 and 20 mm. in length, and 16 and 18 mm. in height.

This species is distinguished by its rhomboid, erect form, its nearly equal length and height, and the divergence of the umbonal slope from the cardinal line, in which respect it resembles *S. quadrangularis*, but is a much smaller form.

Figure 20 is of one of the original specimens from the sandstone of the age of the Panama conglomerate, while the others are from lower beds. Larger collections may show the necessity of separating these two forms, which are from very distinct horizons.

Formation and localities. In the sandstone of the Panama conglomerate, Chautauqua county, and from the middle portion of the Chemung group, near Hobbieville, Alleghany county, N. Y.

Schizodus Chemungensis.

PLATE LXXV, FIGS. 37-40, 45, 41?.

Nuculites Chemungensis, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii. p. 247, pl. 13, fig. 13. 1842.
Schizodus Chemungensis (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 96. 1870.
Cytherodon (Schizodus) Chemungensis (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 37–40. 1883.

Shell large, rhomboid-ovate; length one-fourth greater than the height.

Anterior margin broadly rounded, curving into the basal margin, which is sometimes nearly straight posteriorly. Post-inferior extremity angular. Posterior margin obliquely truncate. Cardinal line straight, less than half the length of the shell.

Valves depressed-convex below, becoming gibbous in the middle and

above. In its usual condition of preservation the shell is very much depressed.

Beaks at about the anterior third, prominent. Umbonal slope sub-angular, defined above, less prominent below.

Surface marked by fine concentric striæ of growth, which are partially preserved in the cast.

Three specimens measure respectively 33, 35 and 43 mm. in length, and 25, 29 and 30 mm. in height.

This species resembles *S. appressus* in form and proportions and is probably only a variety of that species which lived under different conditions.

Formation and localities. In the Chemung group, at Chemung Narrows; near Ithaca and Cortland, and in Lindley township, Steuben county, N. Y.; also in Tioga and Susquehanna counties, Pa.

Schizodus Chemungensis, var. quadrangularis.

PLATE LXXV, FIGS. 31-34, 36.

In part *Schizodus quadrangularis*, Hall. Prelim. Notice Lamellibranchiata, 2, p. 96. 1870.
" *Cytherodon (Schizodus) quadrangularis*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 31–36. 1883.

Shell large, rhomboidal; length somewhat greater than the height; basal margin broadly rounded. Posterior extremity pointed below and truncate above. Cardinal line about half the length of the shell. Anterior end large, broadly rounded.

Valves depressed-convex below, becoming convex or gibbous in the middle and upper portions.

Beaks between the middle and anterior third, prominent, rising above the hinge-line. Umbonal slope distinctly angular, defined, extending to the post-inferior extremity.

Surface marked by fine concentric striæ, which are partially preserved in the casts. The umbonal slope, in the cast, is marked by a sharp angularity extending from the beak half way to the post-inferior extremity. The cardinal slope is marked by a furrow along the middle for half its length.

The pallial line extends at some distance from the margin, terminating in

an elongate posterior muscular impression. Anterior muscular impression strongly marked.

Three specimens measure respectively 30, 34 and 38.5 mm. in length, and 26, 28 and 33 mm. in height.

This form appears to be only a variety of *S. Chemungensis*, with a more erect, distinctly quadrangular outline, and having a wider post-cardinal slope.

Formation and localities. In the Chemung group, on Cayuta creek and at Factoryville in Tioga county; on the banks of Chemung creek and at Ithaca, N. Y.

Schizodus oblatus.

PLATE LXXV, FIGS. 43, 44.

Schizodus oblatus, Hall. Prelim. Notice Lamellibranchiata, 2, p. 97. 1870.
In part *Cytherodon (Schizodus) oblatus*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 41–45. 1883.

Shell of medium size or larger, broadly sub-elliptical; length one-fourth greater than the height; basal margin regularly curving. Post-inferior extremity obtusely angular and the margin above sub-truncate. Cardinal line less than half the length of the shell. Anterior end broadly rounded.

Valves convex in the lower portion, becoming gibbous or ventricose in the middle and above, depressed-convex along the middle of the lower portion of the valve.

Beaks a little anterior to the middle, prominent, broad and rounded. Umbonal slope obtusely sub-angular, extending to the post-inferior extremity.

Surface marked by fine concentric striæ, which are but faintly preserved in the cast.

Muscular impressions strongly marked. The posterior scar, on the cardinal slope, is at about the middle of the height of the valve.

Two specimens measure respectively 30 and 32 mm. in length, and 22 and 24.5 mm. in height.

This form differs from any other of the genus, here noticed, in the prominent

sub-central beaks, the ventricose valves, and in the undefined sub-angular umbonal slope.

Formation and locality. In a sandstone of the Chemung group, at Cold Spring, Napoli, Cattaraugus county, N. Y.

Schizodus degener, n. sp.

PLATE LXIII, FIG. 17.

In part *Cardiomorpha rotunda*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 17-20. 1883.

Shell large, very broadly elliptical; length one-sixth greater than the height. Basal margin broadly curving. Post-inferior extremity scarcely extended beyond the general outline; margin sub-truncate above. Cardinal line less than half the length of the shell. Anterior end large, contracted below the beak and broadly rounded below.

Valves moderately convex in the lower and marginal portions, becoming gibbous in the middle.

Beaks a little anterior to the middle, large and prominent, rising conspicuously above the hinge-line. Umbonal slope obtusely angular above, merging into the general convexity of the shell below the middle.

Surface marked by fine concentric striæ, which are obscurely preserved in the cast.

A specimen has a length of 40 mm. and a height of 33.5 mm.

This species is distinguished from all others except *S. oblatus* by the sub-central position of the beaks, and also by the absence of an umbonal ridge at the post-inferior extremity.

Formation and localities. The specimen figured is recorded as coming from the Chemung group; locality unknown. A single imperfect specimen having similar proportions is from the Chemung group at Lawrenceville, Tioga county, Pa.

Schizodus patulus, n. sp.

PLATE LXIII, FIG. 20.

In part *Cardiomorpha rotunda*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, figs. 17–20. 1883.

Shell very large, broadly ovate; length one-fourth greater than the height. Basal margin broadly curving. Post-inferior extremity narrowly rounded; margin above obliquely sub-truncate. Cardinal line short. Anterior end large, contracted below the beak and broadly rounded below.

Valves moderately convex below, becoming gibbous in the middle.

Beaks a little anterior to the centre, prominent and rising above the hinge-line. Umbonal slope not defined, its continuation indicated by an extension of the shell at the post-inferior angle.

Surface marked by fine concentric striæ which are obscurely preserved on the cast of the interior.

The specimen described has a length of 60 mm. and a height of 45 mm.

This species is distinguished by the sub-central position of the beaks, undefined umbonal ridge and flattened posterior end of the shell.

Formation and locality. In the Chemung group near Tioga, Tioga county, Pa.

Schizodus eminens, n. sp.

PLATE XCV, FIG. 28.

Shell very large, obovate, sub-trigonal; length a little less than the height; basal margin regularly curved. Post-inferior extremity sub-angular. Posterior margin nearly vertically truncate. Cardinal line very short. Anterior end short, broadly curving into the basal margin without limitation.

Valves moderately convex below, becoming gibbous in the middle and above.

Beaks sub-central, prominent, rising a little above the hinge-line. Umbo-

nal slope distinctly angular, slightly arching, and extending to the post-inferior extremity. Post-cardinal slope narrow, gently concave.

Surface marked by fine concentric striæ, which are preserved in the cast, and are fasciculate on some portions of the shell.

The specimen described has a length of 53 mm. and a height of 55 mm.

This species is distinguished by its large size, great elevation, broad rounded base, narrow cardinal slope, and sub-erect umbonal ridge. In these characters it differs very distinctly from any of the other species known in the rocks of New York.

Formation and locality. In the Chemung group, one mile west of Guilford, Chenango county, N. Y.

Schizodus cuneus.

PLATE LXXV, FIGS. 29, 30?.

In part *Cytherodon (Schizodus) cuneus*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 27–30. 1883.

Shell small, ovate-cuneate; length about one-fourth greater than the height; basal margin broadly curved. Post-inferior extremity angular. Posterior margin very obliquely truncate. Cardinal line equal to about half the length of the shell. Anterior end short, contracted just below the beak and regularly rounded below.

Valves gently convex below, becoming gibbous in the middle.

Beaks at about the anterior fourth, moderately prominent. Umbonal slope angular, defined, extending to the post-inferior extremity.

Surface marked by fine fasciculate concentric striæ, the remains of which are still preserved in the cast.

The anterior muscular impression is comparatively large and strongly limited on the posterior side. The impression of the strong cardinal tooth is preserved beneath the beak.

Two specimens measure respectively 20 and 22 mm. in length, and 15 and 15 mm. in height.

This species resembles *S. contractus* of the Hamilton group, but is a larger shell, and differs in the more direct umbonal ridge, less gibbous valves, and in the absence of a sinuosity in the posterior margin.

Formation and locality. In the Waverly sandstone, at Granville, Licking county, O.

Schizodus æqualis, n. sp.

PLATE LXXV, FIG. 35; AND PLATE XCV, FIG. 29.

In part *Cytherodon (Schizodus) quadrangularis*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 31–36 (35 in error). 1883.

Shell large, obovate; body of the shell sub-triangular; length a little greater than the height; basal margin regularly curved. Post-inferior extremity very slightly produced. Posterior margin somewhat vertically truncate. Cardinal line short. Anterior end large, contracted beneath the beak and broadly rounded below.

Valves gently convex below, becoming moderately gibbous in the middle.

Beaks sub-central, elevated, rising considerably above the hinge-line. Umbonal slope obtusely sub-angular, extending to the post-inferior extremity. Post-cardinal slope rather wide, gently concave.

Surface marked by fine concentric striæ, which are partially preserved on the nearly smooth casts.

A large specimen has a length of 52 mm. and a height of 45 mm.

This species bears considerable resemblance to *S. Chemungensis*, var. *quadrangularis*, but the base is more broadly rounded, and the anterior portion is more expanded below, giving the shell a more equilateral appearance.

Formation and locality. In the Waverly sandstone, at Granville, Licking county, O.

PROTHYRIS, MEEK. 1869.

PROTHYRIS PLANULATA.

PLATE LXXVI, FIG. 1; AND PLATE XCIV, FIG. 8.

Prothyris planulata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 76, fig. 1. 1883.

SHELL small, ligulate; length more than twice the height. Basal margin nearly straight, curving anteriorly and truncate behind. Posterior extremity vertically truncate. Cardinal line long, straight, essentially parallel to the basal margin. Anterior end auriculate, limited from the body of the valve by a constriction and deep sinus in the margin.

Valves depressed-convex below, more convex above the middle of the shell. Beaks sub-anterior, low and inconspicuous. Umbonal slope angular, extending to the upper posterior extremity, below which is a shallow groove extending from the umbo to the post-inferior extremity. Post-cardinal slope narrow and concave.

Surface marked by strong concentric striæ, which are aggregated into fascicles along the basal margin.

A specimen of ordinary size has a length of 17 mm. and a height of 7 mm.

This species differs from *P. elegans*, MEEK, in being proportionally higher, with convex basal margin, posterior extremity decidedly truncate, the umbonal slope distinctly angular with a shallow furrow below, extending from the beak to the post-inferior extremity, and in having more irregular concentric striæ.

Formation and localities. In the shales of the Hamilton group at the outlet of Crooked lake and near Norwich, Chenango county, N. Y.

PROTHYRIS LANCEOLATA.

PLATE LXXVI, FIGS. 2-8.

Prothyris lanceolata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 76, figs. 2–8. 1883.

SHELL of medium size, elongate-lanceolate; length three times the height. Basal margin very gently curving, often nearly straight on the anterior half. Posterior extremity pointed, very obliquely truncate above. Cardinal line about two-thirds the length of the shell. Anterior end truncate, margin

reflexed, with a slight constriction behind it and without any conspicuous limiting notch.

Valves moderately convex in the posterior part, gibbous in the middle and umbonal portions.

Beaks sub-anterior, not prominent, slightly incurved. Umbonal slope angular above, extending to the posterior extremity, often merging into the general convexity of the shell below the middle. Post-cardinal slope narrow, slightly concave.

Surface marked by fine concentric striæ, which are sometimes somewhat fasciculate, producing gentle undulations of the surface.

Two specimens measure respectively 15 and 20 mm. in length, and 5 and 7 mm. in height.

This species differs from the preceding in its elongate lanceolate form, obtusely angular umbonal ridge and in the pointed posterior extremity.

Formation and localities. In the shales of the Hamilton group at Fultonham, Schoharie county; Sherburne and Norwich, Chenango county; Pratt's falls, Onondaga county; and on the shores of Cayuga and Canandaigua lakes, N. Y.

Protiiyris alata, n. sp.

PLATE XCIV, FIG. 7.

Shell small; body of the shell narrowly ovate, acute; length twice the height; basal margin gently curving. Posterior extremity pointed. Cardinal line more than half the length of the shell. Anterior end truncated by a vertical groove, beyond which is a narrow parallel fold, which is notched at the base.

Valves regularly convex.

Beaks sub-anterior, low, not defined. Umbonal slope angular, marked below by two or three radiating striæ, which extend from the umbo to the posterior extremity of the shell. Cardinal slope alate, marked by distinct radiating striæ.

Surface marked by very fine concentric striæ, and the cardinal slope by fine radiating striæ.

The specimen described has a length of 8.5 mm. and a height of 4 mm.

This species is distinguished by its alate cardinal slope, which is marked by distinct radiating striæ.

Formation and locality. In the Chemung group, near Philipsburgh, Alleghany county, N. Y.

Prothyris exuta, n. sp.

PLATE XCIV, FIG. 9.

Shell large, elongate-trapezoidal; length more than twice the height; basal margin nearly straight, gently curving toward the posterior extremity. Posterior extremity obliquely truncate. Cardinal line more than half the length of the shell. Anterior end regularly rounded, with a fold and constriction just anterior to the umbo, and a slight notch or sinuosity in the margin at the base of the constriction.

Valves depressed-convex in the lower portion, becoming gibbous in the middle and on the umbonal slope.

Place of the beaks occupied by an opening which appears to have existed during the life of the animal. The margin of this aperture is not fractured, but appears to be entire and to have been slightly reflexed. Umbonal slope obtusely sub-angular, extending in a slightly arcuate direction to the post-inferior extremity.

Surface marked by fine concentric striæ, which are scarcely preserved in the cast.

Two specimens measure respectively 32 and 34 mm. in length, and 13 and 14 mm. in height.

This species somewhat resembles *P. lanceolata*, but it is a larger shell, the posterior termination is at the base and not in the middle, as in that species, and the characters of the anterior end are very different.

The large opening in the place of the beaks appears to have existed in the shell during its life-time, and is a very peculiar feature. It may, perhaps, when further collections are studied, necessitate its separation from typical Prothyris.

Formation and locality. In the upper part of the Chemung group, at Warren, Pa.

SOLEMYA, Lamarck. 1818.

(Janeia, King. 1850.)

Solemya (Janeia) vetusta.

PLATE XLVII, FIGS. 53–55; AND PLATE XCIV, FIG. 10.

Solemya (Janeia) vetusta, Meek. Proc. Acad. Nat. Sci., Phila., p. 10. 1871.
" " " " Pal. Ohio, vol. 1, p. 206, pl. 18, fig. 4. 1873.
Yoldia? valvulus, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 190. 1872.
" " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 47, figs. 53–55. 1883.

Shell of medium size, elongate-elliptical; length more than twice the height; basal margin very gently curved. Posterior extremity rounded. Cardinal line nearly straight, or gently arcuate. Anterior end large, narrower than the posterior, rather abruptly rounded at the extremity, carrying on its upper margin a distinct fold.

Valves moderately convex below, scarcely gibbous in the upper portion.

Beaks inconspicuous, situated anterior to the middle.

Surface marked by regular, distinct, lamellose, undulating, concentric striæ, which are crossed by distant radiating lines, between which the concentric striæ curve downward.

Three specimens measure respectively 26, 27 and 35 in length, and 11, 12 and 15 mm. in height.

A careful examination has shown that this species is closely allied to Solemya, and we have not a sufficient knowledge of the interior structure to separate it from that genus.

Formations and localities. In the cherty layers above the Hydraulic beds, at the falls of the Ohio, in strata referred to the Hamilton group. It is cited by Mr. Meek as occurring in the Corniferous limestone, at Dublin, O.

TELLINOPSIS, Hall. 1870.

Tellinopsis subemarginata.*

PLATE LXXVI, FIGS. 21–31.

Nuculites subemarginata, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 249, pl. 15, fig. 5. 1842.
Tellinopsis subemarginata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 80. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 76, figs. 21–31. 1883.

Shell large, elliptical, sub-quadrate; length more than once and a half the height. Basal margin straight or gently curving. Posterior extremity sub-emarginate in the middle and rounded above and below, sometimes truncate or rounded with no emargination. Cardinal line gently arcuate. Anterior end regularly rounded, large, usually equaling or greater than the posterior half of the shell.

Valves moderately convex below and toward the extremities, becoming gibbous in the middle and umbonal region.

Beaks sub-central, rather prominent, elevated above the hinge-line and incurved. Umbonal slope rounded, distinct, defined above by a depression which is sometimes a furrow extending from the beak to the middle of the posterior margin or below, producing a slight emargination. The post-cardinal slope above the depression is convex.

Surface marked by fine concentric striæ, which are sometimes fascicled, producing undulations of the surface, and also by radiating striæ which are more or less distinct. From the anterior side of the umbo there extends a flattened space, limited on each side by a low ridge, extending to the antero-basal margin, producing an undulation in the direction of concentric striæ.

Five specimens measure respectively 20, 26, 28, 31 and 49 mm. in length, and 12, 16, 16, 19 and 28 mm. in height.

This species has apparently no relation with any other form described in this

* A well-marked specimen of this species in the author's collection bears the following label in Mr. Conrad's handwriting: "*Posidonia tellinoides*, Conrad. Outline fig., p. 1." The reference is to a plate of outline figures never published, and the writer has not found the name recorded in any publication of Mr. Conrad.

volume. It is distinguished by the central position of the beaks, the emarginate posterior end and the peculiar character of the surface radii.

Formation and localities. In the shales of the Hamilton group at Fultonham, Schoharie county, and on the shores of Skaneateles, Otisco, Cayuga, Seneca and Canandaigua lakes; at Smyrna, Chenango county, and in other places in the State of New York.

CIMITARIA, Hall. 1870.

Cimitaria corrugata.

PLATE LXXVII, FIGS. 1–4.

Cypricardites corrugata, Conrad. Jour. Acad. Nat. Sci., vol. viii, p. 244, pl. 13, fig. 6. 1842.
Cimitaria corrugata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 67. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 77, figs. 1–4. 1883.

Shell large, sub-falciform, extremely elongate, with the cardinal line curving upward at the extremities; length three times the height; basal margin regularly curving, with a gentle sinuosity near the anterior end. Posterior extremity vertically or somewhat obliquely truncate. Cardinal line concave, essentially parallel with the basal margin. Anterior end obliquely truncate above and rounded below into the basal margin.

Valves depressed-convex in the lower and posterior portions, more convex and somewhat gibbous in the umbonal region.

Beaks at about the anterior sixth, prominent and incurved. Umbonal slope angular, marked by a distinct fold, which extends to the post-inferior extremity. Post-cardinal slope comparatively wide, marked by one, or several radiating folds, which are sometimes obsolescent. Cincture distinct, extending obliquely backward from the beak to the base, giving a sinuosity to the margin.

Surface marked by numerous fine concentric striæ. The body of the shell is also marked by irregular concentric undulations, which are sometimes interrupted, giving the surface a rugose appearance. The undulations terminate upon the angular umbonal slope, the post-cardinal area being simply

striate. Anterior to the cincture the surface of the shell is marked by fine granulæ or minute pustules.

Three specimens measure respectively 33, 62 and 105 mm. in length, and 13, 22 and 30 mm. in height.

As compared with *C. elongata*, the shell is more distinctly recurved, the cincture is stronger and the granulose striæ are finer. It differs from all other species in the strong irregular concentric undulations on the body of the shell.

Formation and localities. In the Hamilton group, at Sherburne, Pratt's falls and Delphi; and on the shore of Canandaigua lake, N. Y. Mr. CONRAD cites the species from near Smyrna, Chenango county, N. Y.

CIMITARIA ELONGATA.

PLATE LXXVII, FIGS. 5–8.

Cypricardites elongatus, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 51. 1841.
Cimitaria elongata (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 69. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 77, figs. 5–8. 1883.

SHELL below the medium size, as compared with other species of the genus, sub-ensiform; length about two and one-half times the height; basal margin gently curved, slightly sinuate anterior to the middle. Posterior extremity obliquely truncate above. Cardinal line essentially straight. Anterior end short, obliquely truncate from the beak, abruptly rounded below. Lunule very long and sharply defined.

Valves depressed-convex in the lower and posterior portions, and gibbous in the umbonal region.

Beaks sub-anterior, prominent, appressed and incurved. Umbonal slope obtusely sub-angular, extending to the posterior extremity. Post-cardinal slope concave anteriorly, and becoming flattened at the posterior extremity. Cincture a broad undefined depression, extending from the beak to the base of the shell, giving a slight sinuosity to the margin.

Surface marked by fine concentric striæ, which are somewhat irregularly fasciculate, especially on the anterior and posterior portions of the shell.

The surface of the anterior and middle portions of the shell is minutely pustulose and marked by extremely fine radiating striæ, which extend obliquely backward from the beak.

Three specimens measure respectively 43, 50 and 52 mm. in length, and 17, 19 and 22 mm. in height.

This species is distinguished by its straight cardinal line and the gentle curvature of the basal margin, and by the fact that the umbonal ridge extends to the posterior extremity at about the middle of its height, while in the other species it extends to the post-inferior extremity.

Formation and localities. In the Hamilton group at Pratt's falls, Onondaga county, and in Schoharie county, N. Y.

Cimitaria recurva.

PLATE LXXVII, FIGS. 9–14, 16.

Cypricardites recurva, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 245, pl. 13, fig. 18. 1842.
Pterinea punctulata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 116. 1838.
Cypricardites recurva, Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., pp. 152–3. 1842.
Cimitaria recurva (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 68. 1870.
In part " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 77, figs. 9–16. 1883.

Shell large, falcate; length nearly three times the height. Basal margin broadly curving with a slight sinuosity toward the anterior end. Posterior extremity broadly rounded or sub-truncate. Cardinal line long, concave. Anterior end short, broadly rounded, obliquely truncated above by the lunule. Escutcheon large. Lunule long and abruptly limited.

Valves depressed-convex in the basal and posterior portions, becoming gibbous above and in the umbonal region.

Beaks sub-anterior, prominent, appressed and closely incurved. Umbonal slope obtusely angular, curving downward and becoming obsolescent before reaching the post-inferior extremity. Post-cardinal slope broad, flattened or slightly concave. Cincture an undefined flattening or depression, extending from the beak obliquely backward to the base, and producing a slight sinuosity in the margin.

Surface marked by fine concentric striæ, which are irregularly fasciculate and are raised into strong undulations on the anterior portion of the shell. In well-preserved specimens the surface is also marked by fine radiating pustulose striæ. In addition to this the post-cardinal slope is sometimes marked by distant radii.

Four specimens measure respectively 90, 91, 92 and 108 mm. in length, and 35, 36, 35 and 38 mm. in height.

This species is distinguished from all the preceding by its extremely falcate form, more rounded posterior extremity and the strongly pustulose and radiating surface.

Formation and localities. In the Hamilton group near Hamilton and Earlville, Madison county; Pratt's falls and Skaneateles lake, Onondaga county; and Mt. Upton, Chenango county, N. Y.

Cimitaria angulata, n. sp.

PLATE LXXVII, FIG. 15

In part *Cimitaria recurva* (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 77, figs. 9–16. 1883.

Shell large, falcate; length less than three times the height; basal margin gently curved, with a slight sinuosity a little in advance of the anterior third. Posterior extremity obliquely truncate. Cardinal line concave. Anterior end very short, almost vertically truncated by the lunule, and abruptly rounded below.

Valves moderately convex below, depressed on the posterior slope, and gibbous in the umbonal region.

Beaks sub-anterior, prominent and incurved. Umbonal slope prominent, distinctly angular, the angularity extending to the post-inferior extremity. Post-cardinal slope broad, flat or slightly concave. Cincture an undefined depression, extending from the beak to the base and giving a slight sinuosity to the margin.

Surface marked by fine regular concentric striæ which are somewhat fas-

ciculate on the anterior and posterior extremities. The striæ recurve over the umbonal ridge, at a slightly acute angle.

The specimens are casts of the interior in sandstone, and the surface markings are not well preserved. Anterior muscular impression large, not deep, situated just within the margin below the lunule.

A specimen has a length of 82 mm. and a height of 30 mm.

This species resembles *C. recurva*, but differs in the strong angular umbonal ridge, which extends to the post-inferior extremity, and by the sharp recurving of the striæ over this ridge.

Formation and localities. In the Chemung group at Chemung Narrows, and between Elmira and Waverly, Tioga county, N. Y.

PHOLADELLA, Hall. 1870.

Pholadella radiata.

PLATE LXXVIII, FIGS. 15-21; AND PLATE XCVI, FIG. 1.

Nuculites radiata, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 248, pl. 12, fig. 16. 1842.
Pholadella radiata (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 63. 1870.
" " " ." Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 78, figs. 15-20. 1883.
" *truncata*, Hall. Prelim. Notice Lamellibranchiata, 2, p. 64. 1870.
" *ornata*, " Prelim. Notice Lamellibranchiata, 2, p. 64. 1870.

Shell from small to medium size, elongate-ovate, cuneate; length about twice the height. Basal margin regularly rounded, curving in a greater or less degree according to the age of the individual. Posterior extremity more or less obliquely, or sometimes vertically, truncate. Cardinal line straight, sometimes a little concave. Anterior end short, obliquely truncated by the lunule and narrowly rounded below. Escutcheon large and well-defined. Lunule deep, marked by an abrupt incurving of the margin.

Valves, in their usual condition of preservation, moderately convex below and gibbous in the middle. In a well-preserved specimen the valves are very gibbous, the depth of both valves being equal to the height of the shell.

Beaks sub-anterior, prominent, strongly incurved. Cincture extending

from the beaks to the base of the shell as a marked depression and producing a slight sinuosity in the margin. Umbonal slope prominent, often distinctly angular, extending to the post-inferior extremity. Post-cardinal slope gently concave, often marked by a slight fold along the middle or by two or more radii.

Surface marked by fine concentric striæ, and by strong radii diverging from the beak, usually marking that portion of the shell between the cincture and the umbonal ridge, sometimes covering the entire surface

Four specimens measure respectively 19, 22, 28 and 36 mm. in length, and 10, 11, 13 and 18 mm. in height. The largest specimen observed has a length of 43 mm.

The majority of the specimens are of young individuals and present a considerable variety of aspect, chiefly, however, in the development of the radii upon the surface, of which there are sometimes not more than six or seven upon the body of the shell, while in other examples these radii cover the entire surface. The specimens also vary considerably in the form of the posterior extremity, which is sometimes narrowly rounded, often obliquely or vertically truncate. An examination of a sufficient number of specimens shows no reason for retaining the species heretofore indicated as *P. truncata* and *P. ornata.*

Formations and localities. In the shales of the Hamilton group in Schoharie county; near Fabius and at Pratt's falls in Onondaga county, and in some concretionary layers at Eighteen-mile creek, Lake Erie shore, N. Y. It is found in the same horizon near Cumberland, Md.; also in the lower part of the Chemung group at Ithaca, N. Y.

Pholadella parallela.

PLATE LXXVIII, FIGS. 22-24.

Grammysia parallela, Hall. Prelim. Notice Lamellibranchiata, 2, p. 59. 1870.
Pholadella " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 22-24. 1883.

Shell small, short, ovate-cuneate; length less than twice the height; basal margin gently curving or nearly straight. Posterior extremity obliquely

truncate. Cardinal line straight. Anterior end short, obliquely truncate above, and narrowly rounded below.

Valves of moderate convexity below and posteriorly, gibbous in the umbonal region.

Beaks sub-anterior, prominent, arcuate and projecting above the hinge-line. Cincture obscure, scarcely perceptible, except toward the base of the shell, where it produces a slight sinuosity in the striæ and basal margin. Umbonal slope distinctly angular, extending to the post-inferior extremity. Post-cardinal slope wide, distinctly limited.

Surface marked by fine concentric striæ, which become fasciculate, and by strong undulations on the anterior and middle portions of the shell. Radiating striæ sometimes mark the body of the shell, but are often obscure or obsolete.

Three specimens measure respectively 10, 16 and 18 mm. in length, and 6, 9 and 9.5 mm. in height.

This species bears much resemblance to *P. radiata*, but the prevailing forms are smaller, the concentric undulations are much stronger and the radii are obscure or obsolete. This form, however, may prove to be only the immature condition of *P. radiata*.

Formation and localities. In the shales of the Hamilton group, at Fabius, and on the shore of Skaneateles lake, N. Y.

Pholadella Newberryi.

PLATE LXXVIII, FIG. 25.

Pholadella Newberryi, Hall. Prelim. Notice Lamellibranchiata, 2, p. 65. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, fig. 25. 1883.
Allorisma (Sedgwickia?) pleuropistha, Meek. Proc. Acad. Nat. Sci., Phila, vol. 23, p. 14. 1871.
" *(Cercomyopsis)* " " Pal. Ohio, vol. II, p. 309, pl. 13, figs. 4*a*, *b*, *c*. 1875.

Shell large, elongate-ovate, sub-falcate; length less than twice the height. Basal margin regularly curving, with a gentle sinuosity anterior to the middle. Posterior extremity vertically or somewhat obliquely truncate.

Cardinal line concave. Anterior end short, obliquely truncate above and narrowly rounded below.

Valves depressed-convex in the posterior and lower portions, becoming gibbous in the middle and umbonal region.

Beaks at about the anterior fourth, prominent, strongly incurved and rising above the hinge-line. Cincture indicated by a gentle, undefined depression, extending from the beaks downward, producing a slight sinuosity in the basal margin. Umbonal slope angular above, becoming less prominent below and extending to the post-inferior extremity. Post-cardinal slope broad, marked by a more or less distinct longitudinal fold.

Surface marked by fine concentric striæ, which become fasciculate on the anterior and posterior portions of the shell, and by radiating striæ which cover the body of the shell posterior to the beak, occupying the space from the anterior side of the cincture to the umbonal ridge.

Lunule marked by an abrupt infolding of the shell, leaving an angular margin.

Two specimens measure respectively 60 and 70 mm. in length, and 27 and 31 mm. in height.

This species is distinguished by its large size and strong radii which cover the body of the shell. In its general form and expression it is very similar to some varieties of *Cimitaria recurva.*

Formation and locality. In the sandstones of the Waverly group in Licking county, Ohio.

PHTHONIA, Hall. 1870.

[Types *P. sectifrons* and *P. nodicostata.*]

Phthonia cylindrica.

PLATE LXXVIII, FIGS. 1-4.

Phthonia cylindrica, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 1–4. 1883.

Shell of medium size, elongate-elliptical or sub-elliptical; length more than twice the height; basal margin straight or slightly concave, curving into the posterior and anterior margins without interruption. Posterior extremity regularly rounded, sometimes somewhat oblique on the upper posterior margin. Cardinal line very gently arching or nearly straight, about half the length of the shell. Anterior end short, narrowed, and regularly rounded at the extremity.

Valves moderately convex in the lower portion, scarcely gibbous in the middle and upper portion.

Beaks sub-anterior, low, appressed, with sometimes a faint indication of a depression extending from the beak to the basal margin Umbonal slope not defined, rounded, arcuate, becoming obsolete before reaching the post-inferior extremity.

Surface marked by fine, even concentric striæ, and by extremely fine radiating striæ, which are more conspicuous along the middle and posterior portions of the valve below the umbonal slope. (These striæ are not sufficiently indicated in the figures.)

Anterior muscular scar distinct.

Four specimens measure respectively 26, 27, 29 and 30.5 mm. in length, and 11, 12, 12 and 13 mm. in height.

This species differs from the others described in its more elongate-elliptical form, wider anterior end, and finer radiating striæ, which are frequently obsolescent and often obsolete.

Formation and localities. In the shales of the Hamilton group, at Delphi; at Pratt's falls, Onondaga county; and on the shore of Cayuga lake, N. Y.

Phthonia nodicostata.

PLATE LXXVIII, FIGS. 5-9.

Phthonia nodicostata, Hall. Prelim. Notice Lamellibranchiata, 2, p. 71. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 5-9. 1883.

Shell of medium size or larger, rhomboid-obovate; length about twice the greatest height as measured at the posterior end. Basal margin nearly straight along the middle, curving gently upward anteriorly and more abruptly posteriorly. Posterior extremity obliquely sub-truncate above and rounded below. Cardinal line straight, about half the length of the shell, oblique, ascending posteriorly. Anterior end short, somewhat narrowly rounded.

Valves moderately convex below, becoming somewhat gibbous in the middle and umbonal region.

Beaks sub-anterior, small, low, appressed and scarcely rising above the hinge-line. Shell somewhat flattened from the beaks backward to the base. Umbonal slope sub-angular above, gradually merging into the general convexity of the shell before reaching the post-inferior extremity.

Surface marked by fine concentric, sub-lamellose striæ; also by strong radii, extending from the beak over every portion of the shell, and which are more distant from each other on the cardinal slope and anterior end. These radii, at the crossing of the concentric striæ, are marked by transverse nodose or pustulose elevations.

Four specimens measure respectively 23, 31.5, 34 and 35 mm. in length, and greatest height at the posterior end, of 12, 16, 16 and 17 mm., while the height at the beaks is 10, 14, 14 and 14 mm.

This species is distinguished by its great posterior elevation and the strong radii marking the surface.

Formation and localities. In the shales of the Hamilton group, on the shores of Cayuga and Canandaigua lakes; and near Oneonta, N. Y.

Phthonia sectifrons.

PLATE LXXVIII, FIGS. 10-13.

Cypricardites sectifrons, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 245, pl. 13, fig. 8. 1842.
Phthonia sectifrons (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 70. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 10-13. 1883.

Shell above the medium size, elongate, sub-elliptical, somewhat obovate; length more than twice the height measured at the posterior end; basal margin nearly straight in the middle, curving gradually at the anterior and more abruptly at the posterior end. Posterior extremity rounded below, oblique and sub-truncate above. Cardinal line straight, more than half the length of the shell, slightly oblique, rising posteriorly. Anterior end short, narrowly rounded.

Valves depressed-convex along the basal and posterior portions, becoming somewhat gibbous in the middle and above.

Beaks sub-anterior, small, low and appressed. Umbonal slope obtusely sub-angular in the upper part, usually becoming merged in the general convexity before reaching the post-inferior extremity. Above this, and slightly diverging, is another low ridge extending to the middle of the posterior end, and limiting the post-cardinal slope.

Surface marked by fine concentric striæ, and by numerous fine radii extending from the beak to all parts of the shell. The radii on the umbonal ridge and anterior end are stronger than those on the middle of the shell. At the crossing of the radii and concentric striæ, the test is raised into minute elongate nodes, and on the post-cardinal slope the concentric striæ and radii are nearly of equal strength, giving a cancellated and peculiar aspect to the surface.

Three specimens measure respectively 26, 39 and 40 mm. in length, and 13, 15.5 and 17 mm. in height at the posterior end.

This species differs from *P. nodicostata* in its more elongate form, and much finer radii.

Formation and localities. In the shales of the Hamilton group, in Madison county; and at Pratt's falls, in Onondaga county, N. Y.

Phthonia lirata.

PLATE LXXVIII, FIG. 14.

Phthonia lirata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, fig. 14. 1883.

Shell small, elongate-elliptical; length more than twice the height. Basal margin regularly and gently curved. Posterior extremity regularly rounded. Cardinal line nearly straight. Anterior end short, regularly rounded.

Valves regularly convex, approaching to gibbous in the umbonal region.

Beaks sub-anterior, low and appressed, scarcely rising above the hinge-line. Umbonal slope regularly rounded, not defined.

Surface marked by fine concentric striæ, crossed by distant radii, which are less frequent on the middle of the shell and obsolete on the anterior end.

The cardinal margin, just below the hinge-line, on the interior of the valve is marked by two slender grooves.

The specimen described has a length of 8 mm. and a height of 3.5 mm.

This species is distinguished by its regular elliptical form, its small size and slender, distant radii.

Formation and locality. In the Hamilton group at Norton's landing, Cayuga lake, N. Y.

Phthonia truncata, n. sp.

PLATE XCIV, FIG. 4.

Shell above the medium size, sub-trapezoidal; length twice the height as measured at the posterior extremity. Basal margin nearly straight, abruptly recurving at the post-inferior extremity and curving upward in front. Posterior extremity in the lower part almost vertically truncate, obliquely truncate above. Cardinal line oblique, rising toward the posterior end. Anterior end short, abruptly rounded.

Valves depressed-convex along the basal portion and on the post-cardinal slope, somewhat gibbous in the umbonal region.

Beaks sub-anterior, small, appressed, rising very little above the hinge-line. The shell at the umbo is slightly flattened, and this feature is continued to

the base as a broad, undefined depression. Umbonal slope obtusely angular, extending to the post-inferior extremity. Post-cardinal slope wide, marked along the middle of its length by a distant fold.

Surface marked by fine concentric striæ which, on the posterior part of the shell, are somewhat fascicled. Surface also marked by fine, equal radiating striæ, giving the surface a somewhat cancellated appearance. The radii are obscure on the post-cardinal slope and are principally developed in the umbonal depression.

The specimen described has a length of 39 mm. and a height, at the posterior extremity, of 18 mm.

This species somewhat resembles *P. sectifrons*, but is broader and more abruptly truncate at the posterior end, and the umbonal ridge is more distinctly defined.

Formation and locality. In the Chemung group, south-east of Panama, N. Y.

Phthonia nitida, n. sp.

PLATE XCIV, FIGS. 5, 6.

Shell below the medium size, narrow-elliptical; length more than twice the greatest height; basal margin nearly straight, gently curving upward at the anterior and more rapidly at the posterior. Posterior extremity rounded, a little oblique above. Cardinal line nearly straight, or slightly arcuate. Anterior end short, narrowly rounded.

Valves moderately convex below and posteriorly, becoming gibbous in the middle and umbonal region.

Beaks sub-anterior, small, incurved and appressed. Umbo flattened, and this feature is continued, as a broad undefined depression, to the basal margin. Umbonal slope convex, not defined, merging into the general convexity before reaching the post-inferior extremity.

Surface marked by fine, filiform concentric striæ, which sometimes become fasciculate on the posterior and basal portions of the shell; and by fine radiating striæ extending from the beaks over the entire surface, being stronger

upon the body of the shell, more distant on the anterior end, and finer and more closely arranged on the post-cardinal slope.

Two specimens measure respectively 18 and 23 mm. in length, and 8 and 9.5 mm. in height at the posterior extremity.

In its surface characters this species is more nearly related to *P. sectifrons*, but it is more symmetrically elliptical, more convex, the beaks more incurved and there is no fold on the post-cardinal slope.

Formation and localities. In a shale of the Chemung group, near the level of the Alleghany river, at Warren, Pa., associated with *Echinocaris socialis* and other Phyllocarida.

ORTHONOTA, Conrad. 1841.

Orthonota undulata.

PLATE LXXVIII, FIGS. 37–42.

Orthonota undulata, Conrad. Geol. Surv. N. Y., Ann. Rep., p. 51, pl., fig. 6. 1841.
" " " Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 150, fig. 2. 1842.
" " " Hall. Prelim. Notice Lamellibranchiata, 2, p. 87. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 37–42. 1883.

Shell large, extremely elongate, with parallel dorsal and ventral margins; length three times the greatest height; basal margin nearly straight, slightly constricted anterior to the middle. Posterior end somewhat vertically truncate. Cardinal line straight, extending for about three-fourths the length of the shell. Anterior end short, extending for a little distance along the hinge-line and abruptly rounded.

Valves of moderate convexity.

Beaks sub-anterior, small, low, scarcely elevated above the hinge-line. Cincture narrow, distinct, extending from the beak to the basal margin, which is sometimes gently constricted. Umbonal ridge prominent, rounded, limited below by a narrow furrow, and extending to the post-inferior extremity. Cardinal slope wide, marked by a distinct fold along the middle of its length.

Surface marked by fine concentric striæ, which are in some parts crowded and fasciculate on the body of the shell; marked by distinct undulations upon the anterior end and post-cardinal slope.

Four specimens measure respectively 56, 57, 70 and 74 mm. in length, and 18, 19, 22 and 25 mm. in height at the posterior extremity.

This form is one of the typical species of the genus described by Mr. CONRAD, and in the absence of any special knowledge of *O. pholadis* it must be regarded as the type. It is a common form and has been widely recognized.

Formation and localities. In the Hamilton group, at Bear's gulf and Fultonham, Schoharie county; at several places in Otsego and Onondaga counties and on the shores of Seneca, Cayuga and Canandaigua lakes; and rarely in the Genesee valley.

ORTHONOTA CARINATA.

PLATE LXXVIII, FIGS. 34, 35.

Orthonota carinata, CONRAD. Geol. Surv. N. Y., Ann. Rep., p. 51. 1841.
" " " HALL. Prelim. Notice Lamellibranchiata, 2, p. 87. 1870.
" " " " Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 78, figs. 34, 35. 1883.

SHELL small, elongate, cylindrical; length more than five times the height. Basal margin inflected, essentially straight, gradually curving anteriorly and abruptly recurved posteriorly. Posterior extremity doubly emarginate below and obliquely truncate above. Cardinal line long and straight, extending the greater part of the length of the shell. Anterior end short, narrowly rounded.

Valves regularly convex in the anterior half.

Beaks sub-anterior, low, rounded and scarcely defined. Umbonal slope angular, the ridge extending to the post-inferior extremity and limited on the lower side by a narrow groove. Post-cardinal slope longitudinally marked, above the middle, by a strong angular ridge with a smaller longitudinal ridge midway to the umbonal angle. These ridges give the posterior slope of the shell a strongly plicate appearance and produce abrupt sinuosities in

the posterior margin. The umbonal angle and principal cardinal ridge are about equal in length and prominence.

Surface marked by fine concentric striæ which are fasciculate on the body of the shell and produce gentle undulations. The striæ on the cardinal slope and plications are sharply undulated and not fasciculate.

Three specimens measure respectively 25, 34 and 40 mm. in length, and 4, 4 and 6 mm. in height.

This species is much smaller and proportionally more elongate than *O. undulata* and is distinguished by the carinæ on the post-cardinal slope and absence of vertical undulations.

Formation and localities. In the shales of the Hamilton group at Vinegar-brook glen, Norton's landing, Cayuga lake; at Earlville, Madison county; and in Schoharie county. The original locality cited by Mr. CONRAD is at Tinker's falls, Onondaga county, N. Y.

ORTHONOTA ENSIFORMIS.

PLATE LXXVIII, FIG. 36.

Orthonota ensiformis, HALL. Prelim. Notice Lamellibranchiata, 2, p. 89. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, fig. 36. 1883.

SHELL small, ensiform, sub-cylindrical; length eight times the height; basal margin gently curving for the entire length of the shell. Posterior extremity obliquely truncate. Cardinal line concave, parallel to the basal margin, extending nearly the entire length of the shell. Anterior end short and narrowly rounded.

Valves of regular convexity throughout.

Beaks sub-anterior, inconspicuous. Umbonal slope indicated by a slender, low ridge, extending to the post-inferior extremity. Post-cardinal slope marked by a low, angular ridge, which is more conspicuous along the posterior half of the shell.

Surface marked by fine, regular concentric striæ, which are abruptly bent upward at the umbonal angle and undulated on crossing the post-cardinal ridge.

The specimen described is incomplete at the posterior extremity, and had originally a length of about 42 mm. and a height of 5 mm.

This species, in its narrow and extremely elongate form, resembles *O. carinata*, but differs in its ensiform, arcuate character, and the absence of prominent carinæ on the posterior slope.

Formation and locality. In the shales of the Hamilton group, in Schoharie county, N. Y.

ORTHONOTA RIGIDA, n. sp.

PLATE LXXX, FIG. 6.

In part *Sanguinolites undatus*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 80, figs. 5, 6. 1883.

SHELL small, trapezoidal; length more than twice the greatest height; basal margin straight in the posterior half, gradually curving upward toward the anterior end. Posterior extremity nearly vertically truncate. Cardinal line straight, extending for three-fourths the length of the shell. Anterior end scarcely declining from the beaks and rounded below.

Valves depressed-convex below, convex in the umbonal region.

Beaks at about the anterior fourth, small, appressed, scarcely rising above the hinge-line. Umbonal slope angular, extending to the post-inferior extremity. Post-cardinal slope wide, depressed, marked along the centre by a depression, which is defined in the anterior part and obscure toward the posterior.

Surface marked by fine concentric striæ, and by regular continuous concentric undulations, which are less conspicuous toward the basal and cardinal margins.

The specimen described has a length of 28 mm. and a height of 12 mm. at the posterior end.

This species differs from *O. undulata*, in its shorter and broader form, the umbonal slope is more distinctly angular, and is not limited by a groove below; the post-cardinal slope is not so strongly marked by the undulations and has no distinct fold extending along the middle of its length.

Formation and locality. In the Chemung group, near Elmira, N. Y.

ORTHONOTA (?) PARVULA.

PLATE LXV, FIGS. 2, 3; AND PLATE LXXVIII, FIGS. 29-32.

Orthonota parvula, HALL. Prelim. Notice Lamellibranchiata, 2, p. 88. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, figs. 29-32. 1883.
In part *Sanguinolites truncatus* (CONRAD, sp.), HALL. Pal. N. Y., vol. v, pt. I. Plates and Explanations: Pl. 65, figs. 1-3. 1883.

SHELL small, elongate, sub-trapezoidal; length three times the height. Ventral and dorsal margins straight and sub-parallel. Posterior extremity vertically or obliquely truncate below and curving forward above. Anterior end narrowly and regularly rounded from the cardinal margin.

Valves moderately convex below and posteriorly, becoming gibbous in the middle and umbonal regions.

Beaks at about the anterior fourth, flattened and incurved, rising very little above the hinge-line. Umbonal slope angular, extending to the post-inferior extremity. Post-cardinal slope flat or slightly concave, sometimes obscurely marked by a depression or fold below the middle.

Surface marked by extremely fine, thread-like concentric striæ, which are often lamellose on the post-cardinal slope.

Three specimens measure respectively 14, 15 and 20 mm. in length, and 4.5, 5 and 6 mm. in height.

This shell was placed under the genus ORTHONOTA on account of its long, straight hinge-line and absence of a lunule and any indication of external ligament. The two valves are frequently in conjunction as in other species of ORTHONOTA. The surface markings are in no respect like *O. undulata*, but do not differ essentially from *O. carinata*. Its generic relations are still in doubt.

Formation and localities. In the shales of the Hamilton group near Fultonham and Summit, Schoharie county; in Onondaga and Livingston counties; and on the shores of Seneca and Canandaigua lakes, N. Y.

SOLEN.

S. Genus PALÆOSOLEN, n. s. g.

Solen (Palæosolen) siliquoidea.

PLATE LXXVIII, FIG. 33.

Orthonota siliquoidea, Hall. Prelim. Notice Lamellibranchiata, 2, p. 89. 1870.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 78, fig. 33. 1883.

Shell solenoid; length more than four times the greatest height. Basal and cardinal margins sub-parallel. The cardinal margin is straight and the basal margin extends slightly downward posteriorly. Posterior extremity abruptly truncate, gaping. Anterior end very short, straight on the cardinal line and regularly rounded below.

Shell sub-cylindrical. Valves regularly convex their entire length.

Beaks sub-anterior, low and undefined. Umbonal slope marked by a shallow, indistinct diagonal groove, which is merged in the general convexity before reaching the post-inferior extremity. Post-cardinal slope wide, slightly undulated.

Surface marked by fine concentric striæ, the remains of which are preserved in the cast.

The specimen described has a length of 65 mm., a height at the beak of 10 mm., and at the posterior end of 14 mm.

This shell was originally placed under the genus Orthonota from its general similarity in form, and from a disinclination to propose another generic name; but a proper limitation of that genus requires the separation of this species.

This species differs from any of the preceding in the regularly convex, cylindrical form of the entire shell, and the gaping posterior extremity.

Formation and locality. In the arenaceous beds of the Hamilton group in the southern part of Schoharie county, N. Y.

CYPRICARDINIA, Hall. 1859.

Cypricardinia planulata.

PLATE LXXIX, FIGS. 1-5.

Pterinea planulata, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 251, pl. 13, fig. 15. 1842.
Cypricardinia " " Hall. Prelim. Notice Lamellibranchiata, 2, p. 82. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 1–5. 1883.

Shell large, sub-rhomboid-ovate; length one-third greater than the height; basal margin broadly curving, with a shallow sinus anterior to the middle. Posterior extremity abruptly rounded below, sinuate and truncate above. Cardinal line slightly arcuate, oblique. Anterior end short, declining rapidly from the beak, regularly rounded below.

Left valve depressed-convex below, more convex in the middle. Right valve gibbous in the umbonal region.

Beaks sub-anterior, appressed, rising but little above the hinge-line. Cincture very distinct, extending to the base of the shell. Umbonal slope obtusely angular, prominent, extending to the post-inferior extremity. Post-cardinal slope broad, sinuate just above the umbonal ridge.

Surface marked by fine concentric striæ, and at regular intervals by prominent concentric undulations.

Muscular impressions and pallial line, as shown in figs. 3–5, of plate lxxix, representing casts of the interior.

Four specimens measure respectively 15, 21, 26 and 27 mm. in length, and 10, 14, 17 and 19 mm. in height. A large specimen has a length of 30 mm.

This shell is distinguished by its large size, broad form and distinct sinuosity extending along the post-cardinal slope, just above the umbonal ridge.

Formation and localities. In the Schoharie grit, in the Helderberg mountains, and in Schoharie county, N. Y.

Cypricardinia indenta.

PLATE LXXIX, FIGS. 6-16, 23; AND PLATE XCVI, FIG. 2.

Cypricardites indenta, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 244, pl. 12, fig. 12. 1842.
In part *Cypricardinia indenta* (Conrad), Hall. Prelim. Notice Lamellibranchiata, 2, p. 83. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 6-23. 1883.
Cypricardites inflata, Conrad. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 246, pl. 15, fig. 2. 1842.

Shell of medium size, sub-rhomboid-ovate; length more than one-third greater than the height; basal margin nearly straight, slightly sinuate anterior to the middle. Posterior extremity abruptly rounded below and obliquely truncate above. Cardinal line straight, oblique. Anterior end very short, rounded below.

Right valve very convex, often extremely gibbous. Left valve usually depressed-convex below and posteriorly, becoming moderately gibbous in the umbonal region.

Beaks nearly anterior, small and appressed, rising but little above the hinge-line. Cincture distinct on the right valve, less marked upon the left valve. Umbonal slope rounded and prominent on the right valve, subangular on the left valve.

Surface marked by extremely fine concentric striæ and by unequally distant but somewhat regular, lamellose, imbricating, concentric undulations; and in well-preserved specimens the entire surface is marked by fine striæ, which radiate from the apex of the shell, and in some conditions of preservation the surface shows a second set of striæ vertical to the direction of the lamellæ.

Four specimens measure respectively 11, 14, 18 and 20 mm. in length, and 7, 8, 11 and 11 mm. in height.

This species is smaller than the preceding, the right valve, when well-preserved, is more gibbous, the depression or sinus above the umbonal slope is not so distinctly defined, and the posterior margin is not sinuate. This species probably includes the form described as *Cypricardites inflata* by Mr. Conrad, which represents a gibbous specimen as preserved in the limestone. The specimens, figs. 6, 7, 8, are from near the original locality of that species.

Formations and localities. In the Corniferous limestone, at Babcock's hill,

Oneida county, N. Y.; at the falls of the Ohio; and at North Cayuga, Ontario; in the shales of the Hamilton group, on the shores of Erie, Seneca, Cayuga, Canandaigua, Skaneateles and Owasco lakes; and at many other localities in New York, and in Hardy county, Va.

CYPRICARDINIA ARCUATA, n. sp.

PLATE LXXIX, FIG 17.

In part *Cypricardinia indenta* (CONRAD), HALL. Pal. N. Y, vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 6–23. 1883.

A single left valve of this species has been observed. It differs from *C. indenta* in being more convex, and having the form and convexity of a right valve. The umbonal slope is rounded, arcuate and not direct as in the other species. The posterior margin is more vertically truncate, and the cincture and sinuosity of the base are much more strongly marked.

The specimen has a length of 12 mm. and a height of 7 mm.

Other specimens are required to give a full description of the species.

Formation and locality. In the Chemung group, north of Elmira, N. Y.

CYPRICARDINIA? CYLINDRICA.

PLATE LXXIX, FIGS. 24, 25.

Cypricardinia? cylindrica, HALL and WHITFIELD. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 190. 1872.
" " " HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 24, 25. 1883.

The specimen is not accessible at the present time, and its generic relations cannot be satisfactorily determined.

Formation and locality. The original specimen was from the Hydraulic beds of the age of the Hamilton group, near Louisville, Ky.

CYPRICARDINIA CONSIMILIS, n. sp.

PLATE LXXIX, FIGS. 19, 20, 21 (18?); AND PLATE XCVI, FIG. 3.

In part *Cypricardinia indenta* (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 83. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 6–23. 1883.

SHELL small, sub-rhomboidal; length nearly twice the height; basal margin gently curving or nearly straight. Posterior extremity extended below,

narrowly rounded and truncate above. Cardinal line slightly arcuate. Anterior end short, declining abruptly from the beak and rounded below.

Right valve gibbous in the middle and umbonal region. Left valve more depressed.

Beaks sub-anterior, appressed, rising a little above the hinge-line. Cincture shallow, undefined, continued to the basal margin. Umbonal slope obtuse, prominent, extending to the post-inferior extremity.

Surface marked by fine concentric striæ and on the middle and anterior portion by strong regular concentric undulations, which are sometimes duplicate on both sides of the cincture, mainly on the posterior half of the shell. Entire surface covered by fine radiating striæ.

Hinge-line marked in the posterior part by a slender groove.

Three specimens measure respectively 8, 15 and 15.5 mm. in length, and 4.5, 8 and 8.5 mm. in height.

This species resembles *C. indenta* from the Hamilton group, but it is more elongate, comparatively narrower at the posterior end, the umbonal slope in the right valve is more direct than in the right valve of that species.

Formation and localities. In the Waverly sandstones, Licking and Medina counties, Ohio, and at Warren, Pa.

CYPRICARDINIA SULCIFERUS.

PLATE LXXIX, FIG. 22.

Sanguinolites sulciferus, WINCHELL. Proc. Acad. Nat. Sci., Phila., p. 14. 1863.
In part *Cypricardinia indenta* (CONRAD), HALL. Prelim. Notice Lamellibranchiata, 2, p. 83. 1870.
" " " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 6–23. 1883.

The figure is given from a specimen in the Yellow sandstone, at Burlington, Iowa, and is three times enlarged. The material in our possession is not sufficient to determine its intimate relations with the other species. It is, however, marked with fewer undulations than any other form here described.

PALÆANATINA, Hall. 1870.

Palæanatina typa, Hall. 1870.

PLATE LXXIX, FIGS. 26-28, 35-37.

Palæanatina typa, Hall. Prelim. Notice Lamellibranchiata, 2, p. 85. 1870.
In part " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 26-39. 1883.

Shell short-soleniform, elongate, sub-elliptical; length twice the height; basal margin slightly sinuate in the middle, often nearly straight and sometimes gently curving. Posterior extremity abruptly rounded, often sub-truncate. Cardinal line straight, or slightly arcuate. Anterior end short, regularly rounded.

Valves unequally convex, and apparently slightly gaping at both extremities. Left valve somewhat gibbous in the umbonal region. Right valve depressed-convex.

Beaks in advance of the anterior third, appressed, rising but little above the hinge. Cincture very broad, undefined, affecting the lower half of the valve, producing a broad sinuosity in the margin. Umbonal slope obtusely sub-angular, extending to the post-inferior extremity. Cardinal slope nearly flat or slightly concave, with a narrow fold developed near the cardinal line.

Surface marked by fine concentric striæ, which are frequently irregularly fasciculate on the basal portion of the shell.

Four specimens measure respectively 16, 20, 28 and 31 mm. in length, and 7.25, 10, 14 and 15 mm. in height.

The shells of this species vary considerably in form and expression. The umbonal ridge and the post-cardinal fold are variously developed, the umbonal slope being often scarcely angular, and the fold on the cardinal slope sometimes obsolete. The cincture is also sometimes excessively developed, producing a deep and broad sinuosity in the margin. But few specimens of the right valve have been observed; these are depressed, the umbonal slope subdued, the beaks inconspicuous and without any evidence of a fold on the cardinal slope.

Formation and locality. In the conglomerate of the Chemung group, at Portville, Cattaraugus county, N. Y.

Palæanatina solenoides, n. sp.

PLATE LXXIX, FIGS. 38, 39.

In part *Palæanatina typa*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 26–39.

Shell elongate, sub-quadrate; ventral and dorsal margins sub-parallel; length two and one-half times the height; basal margin nearly straight or a little contracted anterior to the middle. Posterior extremity almost vertically truncate. Cardinal line straight. Anterior end short, the upper side extended in continuation with the cardinal line, and curving below.

Left valve regularly convex, scarcely gibbous in the umbonal region. Right valve depressed-convex throughout.

Beaks at about the anterior fourth, that of the left valve rising above the hinge-line and incurved; in the right valve scarcely rising above the cardinal line. In the left valve there is a flattening of the beak, and a broad undefined depression below, extending to the basal margin. Umbonal slope of the left valve obtusely sub-angular for a short distance from the beak, merging into the general convexity before reaching the middle of the shell. In the right valve the umbonal ridge is obsolete. Cardinal slope not distinct from the general convexity.

Surface marked by fine concentric striæ, which become fasciculate on the posterior slope, and are nearly vertical to the hinge-line.

The ligamental area is comparatively short, about one-fourth the length of the shell.

The specimen described has a length of about 42 mm. and a height of 17 mm.

This shell is more elongate than the preceding, the cardinal margin is more extended and straighter, the posterior end truncate; the umbonal ridge is less defined, and there is no evidence of a fold upon the post-cardinal slope.

Formation and locality. In a conglomerate of the Chemung group, near Portville, Alleghany county, N. Y.

Palæanatina angusta, n. sp.

PLATE LXXIX, FIGS. 29-34.

In part *Palæanatina typa*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79, figs. 26–39. 1883.

Shell small, elongate, narrowly elliptical or sub-cylindrical; length from two and a half to three times the height; basal margin straight or slightly sinuate. Posterior extremity obliquely truncate or regularly rounded. Cardinal line straight or slightly declining posteriorly. Anterior end narrow, rounded.

Left valve gibbous in the umbonal region. Right valve less gibbous and more depressed below the umbonal ridge.

Beaks between the anterior third and fourth, small, scarcely rising above the hinge. Umbonal slope obtusely sub-angular, extending to the post-inferior extremity. Post-cardinal slope flat or concave, with a fold in the left valve, a feature not observed in the right valve. There is a shallow undefined depression extending from the umbo to the base, scarcely affecting the margin.

Surface marked by fine concentric striæ, which become fasciculate on the posterior end of the shell.

Five specimens measure respectively 21, 24, 26.5, 30 and 32 mm. in length, and 9, 10, 10, 10 and 10 mm. in height.

Compared with either of the preceding species this shell is comparatively smaller, more elongate, and the difference in the convexity of the valves is less conspicuous.

Farther collections may show the necessity of separating such specimens as are represented in figure 30 of plate lxxix.

Formation and locality. In a conglomerate of the Chemung group, near Portville, Alleghany county, N. Y.

Palæanatina sinuata, n. sp.

PLATE XCVI, FIG. 4.

Shell small, obovate, length about twice the height; basal margin gently curving, straight in the middle. Posterior extremity rounded below and truncate above. Cardinal line gently arcuate. Anterior end narrow, rounded.

Left valve depressed-convex below, becoming gibbous in the umbonal region. Right valve unknown.

Beaks at about the anterior fourth, low, scarcely rising above the hinge-line. The valve, from the beak downward, is depressed, but without a distinct cincture. Umbonal slope prominent, obtusely sub-angular, limited above by a distinct groove or sinus extending to the post-inferior extremity. Cardinal slope convex, limited below by the sinus bordering the umbonal ridge. The cast of the interior preserves the remains of fine concentric striæ, which were abruptly sinuate in passing over the umbonal ridge and sinus.

A specimen has a length of 21 mm. and a height of about 12 mm.

This species is shorter and broader than any of the preceding, and is readily distinguished by the defined umbonal ridge, with the narrow sinus on the upper side.

Formation and locality. In the Chemung group, at Warren, Pa.

PRORHYNCHUS, N. G.

PRORHYNCHUS QUADRATUM.

PLATE LXXIX, FIGS. 40–49; AND PLATE XCVI, FIG. 5.

Palæanatina quadrata (HALL). S. A. MILLER. Cat. Am. Pal. Foss., p. 199. 1877.
" " HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 79. figs. 40–49. 1883.

SHELL large, inequivalve, quadrate, sub-rhomboid; length usually more than one-third greater than the height; basal margin straight or gently rounded, curving upward in front. Posterior extremity almost vertically truncate. Cardinal line straight. Anterior end produced above, sub-nasute, obliquely truncate or gently rounded below.

Left valve depressed-convex below, becoming gibbous in the middle, and especially in the umbonal region. Right valve depressed-convex, almost flat.

Beaks at about the anterior third, appressed, rising but little above the hinge. Umbonal slope of the left valve obtusely angular, somewhat arcuate, extending to the post-inferior angle. Post-cardinal slope broad, marked by an obscure fold below the middle of its length.

Surface marked by fine concentric striæ, the impressions of which are left on the cast of the interior.

The cast shows some striæ or grooves on the posterior portion of the cardinal line; anterior to the beaks there is a groove along the hinge, and a distinct narrow, divergent furrow, extending from the beak half way to the anterior margin.

Four left valves measure respectively 19, 21, 38 and 45 mm. in length, and 12, 15, 22 and 28 mm. in height. Three right valves measure respectively 22, 24 and 32 mm. in length, and 13, 13.5 and 17 mm. in height.

This shell is remarkable for its sub-quadrate, rhomboidal form, long straight hinge-line and the angular or sub-nasute anterior extremity.

Formation and locality. In a coarse sandstone in the upper part of the Chemung group, south of Smethport, Pa.

PRORHYNCHUS NASUTUM, n. sp.

PLATE XCVI, FIG. 6.

SHELL of medium size, sub-rhomboid-obovate; length more than one-third greater than the height; basal margin nearly straight, curving upward in front. Posterior extremity almost vertically truncate. Cardinal line straight. Anterior end nasute above, rounded below.

Left valve depressed-convex in the lower part, gibbous in the upper and umbonal regions. Right valve depressed-convex, scarcely gibbous above.

Beaks anterior to the middle, appressed, incurved, scarcely elevated above the hinge-line in the left valve. In the left valve there is a broad undefined depression, extending vertically from the umbo to the base. Umbonal slope obtusely angular and broad in the left valve, less conspicuous in the right, extending to the post-inferior angle. Post-cardinal slope broad, limited by a shallow longitudinal depression just above the umbonal ridge.

Surface marked by fine concentric striæ, which are sometimes fasciculate.

A specimen has a length of 25 mm. and a height of 18 mm., the length, including the nasute anterior extension, is 29 mm.

This species is distinguished from the preceding by its proportionally greater height, more nearly central beaks, broad umbonal ridge, the nasute anterior extremity and the greater convexity of the right valve.

Formation and locality. In the upper part of the Chemung group, at Warren, Pa.

PRORHYNCHUS ANGULATUM, n. sp.

PLATE XCVI, FIG. 7.

SHELL large, sub-rhomboidal; length and height as five to three; basal margin nearly straight, oblique to the hinge-line. Posterior extremity obliquely truncate, slightly sinuate in the middle. Cardinal line elongate, straight. Anterior end long, narrow, produced above, angular at the extremity and retrally truncate below, to the antero-basal angle.

Right valve depressed-convex, slightly concave from the beak to the base in a broad undefined depression. Left valve unknown.

Beaks behind the anterior third, low, inconspicuous. Umbonal slope defined, prominent, extending to the post-inferior angle, which is abruptly rounded, limited on the upper side by a distinct furrow, which produces a slight sinuosity in the margin. Post-cardinal slope broad.

Surface marked by fine concentric striæ.

A specimen has a length of 53 mm. and a height of 30 mm. at the posterior end, and of 20 mm. at the beak.

This shell is distinguished by its large size, extremely long cardinal line, the retrally truncate anterior end, and the sinuate posterior extremity.

Formation and locality. In the upper part of the Chemung group, at Warren, Pa.

GLOSSITES, N. G.

GLOSSITES TERETIS, n. sp.

PLATE XCVI, FIG. 18.

SHELL below the medium size, elongate, sub-elliptical, narrower in front; length more than twice the greatest height; basal margin broadly curved, sinuate anterior to the middle. Posterior extremity narrowly rounded, and with the margin above sloping acutely forward. Cardinal line slightly oblique, about half the length of the shell. Anterior end short, descending from the beaks and narrowly rounded below.

Valves of moderate convexity below, becoming gibbous in the umbonal region.

Beaks sub-anterior, small, rising but little above the hinge-line. Umbonal slope convex, continued to the post-inferior extremity. Cardinal slope narrow. There is a shallow, undefined cincture extending from the beaks to the anterior part of the basal margin.

Surface marked by fine striæ of growth which are aggregated into irregular fascicles on the body of the shell and umbonal slope. Interior unknown.

The specimen described has a length of 34 mm., a height in the middle of 16 mm., and the depth of both valves is 9 mm.

This species is the only one of the genus yet noticed in the Upper Helderberg group. It somewhat resembles *G. lingualis*, from the Chemung group, but the anterior end is much shorter and more rapidly declining from the beaks, which are more elevated, the umbonal slope is more convex, and the cardinal slope is comparatively narrower.

Formation and locality. In the Corniferous limestone at Littleville, near Avon, Livingston county, N. Y.

Glossites subtenuis, n. sp.

PLATE XL, FIGS. 12, 20.

In part *Modiomorpha? amygdalina* (Winchell), Hall. Prelim. Notice Lamellibranchiata, 2, p. 78. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 12–20. 1883.
Not *Sanguinolites amygdalinus*, Winchell. Proc. Acad. Nat. Sci., Phila., p. 13. 1863.

Shell small, elongate-elliptical; length twice the height; basal margin very gently curved, turning abruptly to the anterior and posterior. Posterior extremity regularly rounded. Cardinal margin nearly straight. Anterior end short, without limitation, gently declining from the beak and abruptly rounded at the extremity.

Valves depressed-convex in the basal and posterior portions of the shell, becoming moderately convex in the umbonal region.

Beaks sub-anterior, small, closely appressed. Umbonal slope not defined.

Test thin, marked by fine concentric striæ, which are fasciculate upon the umbonal slope and posterior region, giving prominent undulations to the surface. Interior unknown.

One of the specimens described has a length of 32 mm. and a height of 15 mm. A comparatively broader specimen measures 30 mm. in length and 15 mm. in height.

Compared with *G. amygdalina*, this species has a narrower shell with a shorter anterior end; the posterior end is narrower and the striæ curve and

become almost parallel to the cardinal border, while in that species the striæ terminate abruptly at the cardinal line.

Formation and locality. In the central portion of the Hamilton group, near Geneva, N. Y.

GLOSSITES DEPRESSUS, n. sp.

PLATE XL, FIGS. 15, 17; AND PLATE XCVI, FIG. 12.

In part *Modiomorpha? amygdalina* (WINCHELL), HALL. Prelim. Notice Lamellibranchiata, 2, p. 78. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 12–20 1883.
Not *Sanguinolites amygdalinus*, WINCHELL. Proc. Acad. Nat. Sci., Phila., p. 13. 1863.

SHELL above the medium size, sub-elliptical, wider behind; length about twice the height; basal margin gently curved to near the extremities, where it rapidly recurves. Posterior extremity abruptly rounded, obliquely subtruncated on its upper portion. Cardinal margin gently arcuate for its entire length. Anterior end slightly produced, rapidly declining from the beak and narrowly rounded below.

Valves depressed-convex in the posterior and basal portions, becoming moderately convex in the umbonal region.

Beaks sub-anterior, small and closely appressed, scarcely rising above the hinge-line. Umbonal slope not defined.

Surface marked by fine concentric striæ, which are fasciculate upon the middle and posterior portions of the shell, producing undulations of the surface which are sometimes strongly marked in the cast.

Anterior muscular impression shallow, close to the anterior margin.

One of the specimens described has a length of 50 mm. and a height of 26 mm. A smaller individual measures 47 mm. in length and 24 mm. in height.

This species closely resembles *G. lingualis*, but the anterior end is proportionally shorter and the valves are more expanded posteriorly.

Formation and localities. In the shaly sandstones of the middle portion of the Chemung group, at Buck's quarry, north-west of Elmira, associated with *Orthis impressa;* and near Elmira, associated with *Orthis Tioga* and *Leptodesma protextum.*

Glossites lingualis, n. sp.

PLATE XL, FIGS. 16, 19; AND PLATE XCVI, FIGS. 9-11.

In part *Modiomorpha? amygdalina* (Winchell), Hall. Prelim. Notice Lamellibranchiata, 2, p. 78. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 12–20. 1883.
Not *Sanguinolites amygdalinus*, Winchell. Proc. Acad. Nat. Sci., Phila., p. 13. 1863.

Shell of medium size or larger, elongate-sub-elliptical; length usually a little more than twice the height; basal margin gently curved. Posterior extremity narrowly rounded. Cardinal margin slightly arcuate. Anterior end somewhat produced, declining from the beaks to about the middle of the height and abruptly rounded below.

Valves depressed-convex below the middle and on the posterior portion, becoming moderately convex in the umbonal region.

Beaks at about the anterior fourth or fifth, small and closely appressed, not rising above the hinge-line. Umbonal slope not defined. Some specimens show a slight flattening or constriction of the valves extending from the beaks to the base.

Test marked by fine striæ of growth, which are often fasciculate on the body of the shell producing undulations of the surface.

The cardinal border is distinctly flattened and there are indications of an elongate tooth posterior to the beaks. The upper anterior margin is also flattened in the cast, and this feature probably indicates the limits of the lunule.

Four specimens measure respectively 30, 32, 39 and 56 mm. in length, and 14, 14, 18 and 25 mm. in height.

This species is distinguished from *G. depressus* by its longer anterior end, more elongate elliptical form; and the cardinal line is not oblique, as in that species.

Specimens are abundant in some parts of the Chemung group, and are subject to considerable variation, due to the nature of the matrix and the condition of preservation.

Formation and localities. In the Chemung group at Phillipsburgh, N. Y., and at Mansfield, Pa.

Glossites ellipticus, n. sp.

PLATE XCVI, FIG. 8.

Shell above the medium size, elongate-elliptical; length more than twice the height; basal margin very gently curved, nearly straight in the middle. Posterior extremity narrowly rounded, extending obliquely forward above to the hinge-line. Cardinal line gently arcuate. Anterior end obliquely truncate above by the long lunule, and abruptly rounded below.

Valves depressed-convex in the lower and posterior portion, becoming convex in the middle and umbonal regions.

Beaks at about the anterior fifth, small and closely appressed, rising but very little above the hinge. Umbonal slope moderately convex above, not defined toward the post-inferior extremity.

Surface marked by fine concentric striæ, which are fasciculate on the body of the shell, producing somewhat regular undulations. Interior unknown.

The specimen described has a length of 59 mm. and a height of 25 mm.

This species is distinguished by its regular elongate-elliptical form. The specimen, forming the basis of the description, retains both valves and preserves the hinge ligament. The ligament is strong and extends backward from the beaks about 19 mm.

Formation and locality. In a fine-grained sandstone of the Chemung group, at Mansfield, Tioga county, Pa.

Glossites rudicula, n. sp.

PLATE XCVI, FIG. 17.

Shell of medium size, elongate-elliptical, wider behind the middle; length more than twice the height; basal margin gently curved in the posterior portion, becoming nearly straight anterior to the middle. Posterior extremity narrowly rounded, with the upper margin extending very obliquely forward to the hinge. Cardinal line slightly oblique and gently arcuate. Anterior end narrow, sloping rapidly from the beak and abruptly rounded at the extremity.

Valves depressed-convex in the lower and posterior portion, becoming convex in the umbonal region.

Beaks at about the anterior fifth, small and appressed, rising but little above the hinge-line. Umbonal slope convex above, not defined toward the post-inferior extremity.

Surface marked by fine concentric striæ, which are fasciculate, and produce undulations of the surface at irregular intervals, and are more conspicuous on the posterior half of the shell. Anterior muscular scar situated just below the lunule, near the anterior extremity. Cardinal margin flattened as in other species of this genus.

Two specimens measure respectively 40 and 51 mm. in length, and 17 and 22 mm. in height.

This species resembles *G. depressus*, but is distinguished by its greater convexity, more elongate form, and much more extended anterior end.

Formation and locality. In a red sandstone of the Chemung group, at Nelson, Tioga county, Pa.

Glossites procerus, n. sp.

PLATE XCVI, FIG. 13.

Shell above the medium size, elongate-sub-elliptical, narrower in front; length two and one-half times the height; basal margin gently curved, abruptly rounded into both extremities. Posterior margin recurved to the hinge-line. Cardinal line gently arcuate. Anterior end produced, declining from the beaks and narrowly rounded in the lower part.

Valves depressed-convex in the lower and posterior portions, becoming moderately convex along the middle and in the umbonal region.

Beaks at about the anterior fifth, small and closely appressed. Umbonal slope not strongly defined, but the convexity continues to the post-inferior extremity.

Surface marked by fine striæ of growth, which are sometimes fasciculate, forming concentric undulations. Anterior muscular scar strongly developed.

The specimen described has a length of 57 mm. and a height of 22 mm.

This species is distinguished from *G. lingualis* in its more elongate form, narrower anterior end and by the convexity of the umbonal slope continuing to the post-inferior extremity.

Formation and locality. In a micaceous red sandstone of the Chemung group, at Mansfield, Tioga county, Pa.

Glossites subnasutus, n. sp.

PLATE XCVI, FIG. 14.

Shell of medium size, elongate-sub-elliptical; length more than twice the height; basal margin gently curved, nearly straight in the middle. Posterior extremity produced and sub-nasute below, curving forward above to the hinge-line. Cardinal line gently arcuate, about half the length of the shell. Anterior end declining from the beak and narrowly rounded.

Valves depressed-convex below and posteriorly, becoming convex in the middle and above.

Beaks at about the anterior sixth, directed forward, low and appressed, rising but little above the hinge-line. Umbonal slope convex, continuing to the post-inferior extremity, and producing a sub-nasute extension of the margin.

Surface marked by fine concentric striæ, which are often fasciculate, and sometimes produce regular undulations of the surface on the umbo.

Two specimens measure respectively 44 and 38 mm. in length, and 18 and 16 mm. in height.

This species is distinguished by the nasute extension of the post-inferior extremity, in which character it differs from any other species here described.

Formation and locality. In a sandstone of the Chemung group, at Mansfield, Tioga county, Pa.

Glossites patulus, n. sp.

PLATE XCVI, FIGS. 15, 16.

Shell of medium size or larger; length less than twice the height; basal margin gently curved posteriorly, becoming nearly straight anterior to the middle. Posterior extremity abruptly rounded below, and obliquely sub-truncate above. Cardinal line depressed, oblique, and gently arcuate. Anterior end obliquely truncated by the lunule and narrowly rounded below.

Valves depressed-convex in the lower and posterior portions, becoming moderately convex in the umbonal region.

Beaks at the anterior fourth or fifth, small and closely appressed. Umbonal slope convex above, becoming depressed toward the post-inferior extremity.

Surface marked by fine striæ of growth, which are fascicled and produce concentric undulations on the body of the shell. Anterior muscular scar moderately impressed, situated just within the anterior border below the lunule.

Four specimens measure respectively 28, 36, 45 and 50 mm. in length, and 17, 20, 25 and 28 mm. in height.

This species is distinguished by its broad, flattened form, in which characters it differs from any other species of the genus noticed in this volume.

Formation and localities. In the Chemung group, at Rockville, N. Y., and Mansfield, Pa.

Glossites amygdalinus.

PLATE XL, FIGS. 13, 14.

Sanguinolites amygdalinus, Winchell. Proc. Acad. Nat. Sci., Phila., p. 13. 1863.
In part *Modiomorpha ? amygdalina* (Winchell), Hall. Prelim. Notice Lamellibranchiata, 2, p. 78. 1870.
" " " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 12–20. 1883.

Shell below the medium size, sub-elliptical; length a little more than twice the height. Basal margin gently curved, abruptly rounded into both extremi-

ties. Posterior extremity rounded, nearly vertically sub-truncate above. Cardinal line slightly arcuate. Anterior end short, declining rapidly from the beaks and abruptly rounded below.

Valves depressed-convex in the lower and posterior portions, becoming convex in the umbonal region.

Beaks at about the anterior fifth, small and closely appressed. Umbonal slope not defined.

Surface marked by fine striæ of growth which are fasciculate on the body of the shell and form undulations at irregular intervals. Interior unknown.

A specimen has a length of 35 mm. and a height of 17 mm.

This species somewhat resembles *G. depressus*, but the beaks are farther from the anterior extremity, the cardinal line is not oblique, and the valves are narrower behind.

Formation and locality. In the Yellow sandstones at Burlington, Iowa.

ELYMELLA, N. G.

ELYMELLA FABALIS, n. sp.

PLATE XL, FIGS. 5, 9.

In part *Modiomorpha? hyalea*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 5–11. 1883.
Not " " " Prelim. Notice Lamellibranchiata, 2, p. 79. 1870.

SHELL small, sub-elliptical, narrower in front; length more than one-half greater than the height; basal margin regularly convex, curving more gently to the anterior and more abruptly to the posterior. Posterior end symmetrically rounded; cardinal margin nearly straight, gently sloping posteriorly. Anterior end very short, declining abruptly from the beak and narrowly rounded below. Lunule deeply impressed.

Valves regularly convex posteriorly, becoming gently gibbous in the middle and umbonal region.

Hinge-line direct, about half the length of the shell.

Beaks anterior, rounded and closely appressed. Umbonal ridge not defined.

Test thin, marked by fine, regular concentric striæ, which become crowded on the anterior end and sometimes fasciculate on the body of the shell. Interior unknown.

A medium-sized specimen has a length of 14 mm. and height of 8 mm. A larger specimen measures 15 mm. in length and 9 mm. in height.

This species is distinguished by its small size, regularly curving base, and symmetrical posterior extremity.

Formation and localities. In the soft shales of the Hamilton group, on the shores of Seneca and Cayuga lakes.

Elymella nuculoides, n. sp.

PLATE XL, FIGS. 6, 7, 8, 10?

In part *Modiomorpha? hyalea*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 5–11. 1883.
Not " " " Prelim. Notice Lamellibranchiata, 2, p. 79. 1870.

Shell small, broad, obliquely ovate; length more than one-half greater than the height; basal margin regularly curving, more abruptly recurving at the anterior end; posterior margin regularly rounded, recurving into the cardinal line, which is straight for half its length. Anterior end short, regularly rounded.

Valves moderately convex on the posterior and ventral portions, becoming gibbous in the middle and umbonal regions.

Hinge-line straight, extending a little less than half the length of the shell.

Beaks anterior, prominent and incurved, rising little above the hinge-line. Umbonal region regularly gibbous, without defined ridge. When the shell is partially compressed, it develops an undefined ridge in the line of the umbonal slope.

Test moderately thick, marked by fine concentric striæ which are fasciculate on the body of the shell, giving rise to strong undulations. Interior unknown.

A medium-sized specimen has a length of 28 mm. and a height of 17 mm. A larger individual measures 30 mm. in length and 18 mm. in height.

Compared with *E. fabulis*, this species has a stronger test, with a greater proportional height and much stronger surface characters. It is similar in many respects to *E. patula*, but is less oblique, umbonal region more prominent, and the anterior end shorter.

Formation and localities. In the Hamilton shales; at Hamburgh-on-the-Lake, Erie county; Ludlowville, Tompkins county, and Cooperstown, Otsego county, N. Y.

Elymella levata, n. sp.

Shell of medium size, sub-elliptical, wider behind; length about twice the greatest height; basal margin nearly straight, scarcely sinuate anterior to the middle, curving regularly to the anterior and posterior ends. Posterior extremity symmetrically rounded, the greatest extension being below the middle of the height. Cardinal line straight for less than half the length of the shell, and curving posteriorly. Anterior end very short, declining abruptly from the beak and rounded below. Lunule well-defined.

Valves regularly convex on the posterior half, becoming gibbous in the middle and umbonal region.

Beaks sub-anterior, small, appressed. Umbonal slope prominent, not strongly defined, becoming merged in the general convexity posterior to the middle of the shell. The valves are flattened just below the beaks, and a slight depression continues to the base, producing a gentle sinuosity in the margin. Post-cardinal slope wide.

Surface marked by fine striæ of growth which are more or less fasciculate. The striæ curve over the posterior slope and extend forward along the cardinal line nearly parallel with it. The substance of the shell is marked by distinct radii, which are sometimes obscurely defined upon the surface.

The specimen described has a length of 27 mm. and a height at the posterior extremity of 14 mm., and at the beaks of 10.5 mm.

This species is proportionally more elongate than any other in the genus, and is also distinguished by the flattening which extends from the beaks to the base, producing a slight sinuosity in the margin.

Formation and locality. In the shales of the Hamilton group, near Jefferson, Schoharie county, N. Y.

Elymella patula, n. sp.

PLATE XL, FIG. 11.

In part *Modiomorpha? hyalea*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 5–11. 1883.
Not " " " Prelim. Notice Lamellibranchiata, 2, p. 79. 1870.

Shell below the medium size, obliquely sub-ovate, broader anteriorly; length one-third greater than the height; basal margin gently curved, abruptly recurving into the anterior and posterior extremities; posterior margin abruptly rounded, more gently recurving to the hinge-line; cardinal margin nearly straight for about half the length of the shell, then gently curving toward the posterior end. Anterior end regularly rounded, short, abruptly curving into the lunule, not limited by any sinus or depression.

Valves depressed-convex in the posterior and lower portion, and more convex in the umbonal region.

Hinge-line straight, about one-half the length of the shell.

Beaks small, sub-anterior, distinct, incurved. Umbonal region moderately convex, not defined nor continued as a ridge on the posterior slope.

Test thin, marked by fine, sharp, elevated concentric striæ, which are sometimes aggregated into fascicles, giving the surface an undulated character. Interior unknown.

The specimen has a length of 32 mm. and a height of 20 mm.

This species resembles *E. nuculoides*, but differs in the slightly longer and wider anterior end, less gibbous valves and less prominent umbo; the posterior end is also more narrowed toward the extremity.

Formation and locality. In the shales of the Waverly group, at Medina, O.

Sphenotus (?) undatus.

PLATE LXXX, FIG. 5.

In part *Sanguinolites undatus*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 80, figs. 5, 6. 1883.

Shell large, elongate-ovate, wider behind; length more than twice the greatest height; basal margin nearly straight, gently curving to the posterior extremity and more abruptly curving anteriorly. Posterior margin oblique, gently rounded or sub-truncate. Cardinal line straight, more than half the length of the shell. Anterior end narrowly rounded.

Valves depressed-convex in the basal and posterior portions, becoming convex and scarcely gibbous in the umbonal region.

Beaks sub-anterior, small, closely appressed, rising very little above the hinge-line. Umbonal slope obtusely angular, extending to the post-inferior margin. Post-cardinal slope wide, essentially flat, with a narrow, obscure fold a little below the hinge-line. Cincture obsolete.

Surface marked by fine concentric striæ, which become fasciculate, producing regular, strong, rounded folds or undulations, which are stronger on the middle of the shell and become obsolete in passing the umbonal ridge. Interior unknown.

The specimen described has a length of 67 mm. and a height of 28 mm.

This species differs from others referred to this genus in the strong concentric undulations and in the absence or obsolescence of a cincture. It is placed under this genus with some hesitation, since only two specimens have been observed, and we have no knowledge of its interior characters.

Formation and localities. In the sandstones of the Chemung group at Mansfield, Pa., and Erwin, Steuben county, N. Y.

GRAMMYSIA? SUBNASUTA.

PLATE LXIV, FIGS. 5, 6.

Edmondia subnasuta, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 5, 6. 1883.

SHELL somewhat below the medium size, narrowly ovate or trapezoidal in outline; length more than one-third greater than the height; basal margin regularly curving from the post-inferior angle to the middle of the anterior end. Posterior extremity obliquely sub-truncate. Cardinal line nearly straight, gently declining posteriorly from the beaks. Anterior end narrowly rounded.

Left valve regularly convex below, becoming gibbous in the middle and umbonal region.

Beaks at about the anterior third, prominent and rising above the hinge-line. Umbonal slope not distinctly defined, gibbous and extending to the post-inferior extremity, producing a sub-nasute extension.

Surface of the cast marked by fine concentric striæ, and at the anterior end there are some remains of concentric ridges which are obscurely visible in the cast of the body of the shell. Interior unknown.

A specimen of normal proportions has a length of 35 mm. and a height of 20 mm.

This species may be compared with *G. glabra*, but it is a much narrower form, with a proportionally longer hinge-line and more pointed and truncate posterior extremity. The shell is clearly not related to EDMONDIA, but its generic relations are more nearly with GRAMMYSIA.

Formation and locality. In the coarse sandstone or conglomerate of the Chemung group, at Portville, N. Y.

SANGUINOLITES, McCoy. 1844.

Sanguinolites (?) undulatus.

PLATE LXIV, FIGS. 1, 2.

In part *Edmondia undulata*, Hall. Prelim. Notice Lamellibranchiata, 2, p 91. 1870.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 1–4. 1883.

Shell small, elliptical; length more than one-third greater than the height; basal margin gently convex. Posterior extremity broadly and regularly rounded. Cardinal line straight. Anterior end short and regularly rounded from just below the beaks.

Valves uniformly convex below, gibbous above and in the umbonal region.

Beaks at about the anterior third, but little elevated above the hinge-line. Umbonal slope not distinguished from the general convex surface of the shell.

Surface marked by fine concentric striæ, which are fasciculate, giving origin to regular concentric undulations, which extend from the anterior end to the post-cardinal slope. Interior unknown.

Three specimens measure respectively 24, 22 and 21 mm. in length, and 14, 14 and 13 mm. in height.

This species differs from the following (*S. subtruncatus*) in its stronger concentric undulations, more rounded posterior extremity and the absence of an umbonal ridge.

Formation and localities. In the sandy shales of the Chemung group, near Great Valley and East Randolph, Cattaraugus county, N. Y.

Sanguinolites (?) subtruncatus, n. sp.

PLATE LXIV, FIGS. 3, 4.

In part *Edmondia undulata*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 64, figs. 1–4. 1883.

Shell small, sub-elliptical, truncate posteriorly; length more than one-third greater than the height; basal margin very gently curving, appearing to be

nearly straight, abruptly recurving at the posterior extremity, which is almost vertically truncate. Cardinal line straight, scarcely declining posteriorly. Anterior end short and abruptly rounded below.

Valves regularly convex below, becoming gibbous in the middle and above.

Beaks near the anterior third, incurved and rising but little above the hinge-line. Umbonal slope obtusely angular, extending to the post-inferior extremity.

Surface marked by fine concentric striæ, which become fasciculate and are elevated into somewhat irregular concentric undulations, which extend from near the anterior end over the umbonal slope. Interior unknown.

Two specimens measure respectively 24 and 22 mm. in length, and 13 and 13 mm. in height.

Formation and localities. In the arenaceous shales of the Chemung group, at Connewango, Cattaraugus county, and Cherry Creek, Chautauqua county, N. Y.

PROTOMYA, N. G.

PROTOMYA OBLONGA.

PLATE LXIII, FIG. 21.

Cardiomorpha oblonga, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 63, fig. 21. 1883.

SHELL large, elongate-ovate, narrower behind; length twice the height; basal margin very gently curving. Posterior extremity gaping, regularly rounded. Cardinal line gently declining posteriorly. Anterior end large, rounded.

Valves moderately and regularly convex.

Beaks a little anterior to the middle of the length, low, not strongly defined, rising but little above the hinge-line. Umbonal slope regularly convex, not defined.

Surface, in the cast, marked by fine concentric striæ, which are aggregated into fascicles, producing low undulations of the surface.

Anterior muscular impression strongly marked, situated just within the

anterior border of the shell. Posterior scar large, round, situated on the post-cardinal slope.

The two specimens observed measure respectively 67 and 72 mm. in length, and 32 and 36 mm. in height.

The species is represented by two specimens, both occurring in the Hamilton group, and it is so distinct from any other form as to preclude comparisons. Its general form and aspect is somewhat similar to some forms of PANOPÆA.

Formation and locality. In the sandy shales of the Hamilton group, at Fultonham, Schoharie county, N. Y., associated with *Leiopteria Bigsbyi*, *Goniophora Hamiltonensis* and *Rhynchonella congregata.*

PROMACRUS, MEEK. 1871.

PROMACRUS CUNEATUS.

PLATE LXXVIII, FIG. 28.

Pholadella cuneata, HALL. Prelim. Notice Lamellibranchiata, 2, p. 66. 1870.
" *decussata*, " Pal. N. Y. vol. v, pt. 1. Plates and Explanations: Pl. 78, fig. 28. 1883.

SHELL below the medium size, elongate, attenuate, sub-cuneate anterior to the beak.

The specimen is a fragment, preserving the anterior end and the beak. It proves, upon comparison with *Promacrus Missouriensis*, to belong to the same genus. It is distinguished by its smaller size, stronger and more regular concentric undulations, and distinct continuous radii of the surface, which become nodose at their intersections with the concentric undulations.

The specimen, anterior to the beak, has a length of 45 mm. and a height at the beak of 24 mm.

Formation and locality. In the Yellow sandstones, at Burlington, Ia.

CYTHERODON, Hall. 1873.

Cytherodon nasutus.

PLATE LXXV, FIGS. 10–12; AND PLATE XCV, FIG. 30.

Cytherodon ——, Hall. Twenty-third Ann. Rep. N. Y. State Cab. Nat. Hist. Ex. pl., pl. 14, fig. 21. 1872.
" (*Schizodus*) *nasutus*, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 75, figs. 10–12. 1883.

Shell large, obliquely ovate or sub-rhomboidal; length a little greater than the height. Basal margin broadly rounded in the middle and anterior portion, constricted near the post-inferior extremity, which is sub-nasute and abruptly rounded. Posterior margin obliquely sub-truncate. Cardinal line arcuate, declining posteriorly. Anterior end short, sloping very rapidly from the beaks and rounded below.

Valves convex in the lower and posterior portions, becoming gibbous in the middle and umbonal region.

Beaks at about the anterior fourth, small, attenuate, rising above the hinge-line. Umbonal slope defined by a flattening of the valve or shallow furrow extending from the beaks to the sinus in the basal margin. Post-cardinal slope moderately convex, with the margin abruptly descending from the umbonal slope to the cardinal line.

Test thick. Surface marked by fine concentric striæ which are sometimes aggregated into fascicles.

Muscular scars distinct. Inter-pallial area in the cast marked by numerous, very small pustules. Hinge thickened, encroaching upon the cavity of the beaks, which is excavate in the cast of the interior. Cardinal teeth interlocking, situated beneath and anterior to the beaks. There are apparently four cardinal teeth in the right valve and five in the left.

The specimen described is a cast of the interior, and imperfect along the basal margin. When entire it has measured about 53 mm. in length and about 50 mm. in height.

In its general form this fossil somewhat resembles several species of Schizodus,

but the characters of the hinge are very distinctive, and there is no defined umbonal ridge extending to the post-inferior extremity.

Formation and locality. In the shales of the Hamilton group, in Hardy county, Va.

CLINOPISTHA, Meek and Worthen. 1870.

Clinopistha subnasuta.

PLATE LI, FIGS. 32, 33; AND PLATE XCV, FIG. 31.

Tellinomya [*Dystactella*] *subnasuta*, Hall and Whitfield. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist.,.p. 191. 1872.

Dystactella subnasuta (Hall and Whitfield), S. A. Miller. Cat. Am. Pal. Foss., p. 190. 1877.
" " " " Hall. Pal. N. Y., vol. v, pt. i. Plates and Explanations: Pl. 51, figs. 32, 33. 1883.

Shell small, narrowly sub-elliptical, nearly straight on the basal side; length about twice the height. Basal margin nearly straight, curving abruptly to the anterior and more gently to the posterior end. Posterior extremity rounded. Cardinal line gently arcuate. Anterior end short, sub-nasute, declining from the beaks and narrowly rounded below. The place of the lunule is occupied by a fold or callosity which is distinctly limited by the margins of the valve.

Valves moderately convex below and posteriorly, gibbous in the umbonal region.

Beaks at about the anterior third, small, closely appressed. Umbonla slope convex, not defined.

Test thin. Surface marked by somewhat regular, fine, thread-like striæ of growth, which in the perfect condition of the shell may have been lamellose, and are fasciculate on some individuals.

The hinge shows some appearance of having been crenulated, but the condition of the specimens is such as not to admit of positive determination. Muscular impressions distinct. Pallial line entire, marked in the cast by a series of radiating pustules.

Three specimens measure respectively 21, 26 and 27 mm. in length, and 12, 13 and 13 mm. in height.

This species bears some general resemblance to the fossil referred to *Solemya vetusta*, especially in the fold of the shell on the upper anterior margin, and it may prove congeneric with that form.

Formation and locality. In the cherty layers above the Hydraulic limestone, near Louisville, Ky.

Clinopistha telliniformis.

PLATE LI, FIGS. 28-31.

Dystactella telliniformis, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 51, figs. 28-31. 1883.

Shell large, obovate; length less than twice the height. Basal margin gently curved, nearly straight anterior to the middle. Posterior end large and rounded. Cardinal line arcuate. Anterior end produced, nasute, obliquely truncate above.

Valves gibbous in the middle and umbonal region.

Beaks behind the anterior third, not prominent. Umbonal slope rounded, not defined. Umbo flattened in the middle and the flattening continued vertically to the base. On the anterior end there is a distinct angular ridge on each valve, extending from the beaks to the antero-inferior extremity.

Surface marked by fine striæ of growth very obscurely preserved in the specimens described, which are casts of the interior. Interior unknown.

A large specimen has a length of 65 mm. and a height of about 38 mm. An imperfect specimen has a height of 35 mm., a length anterior to the beaks of 30 mm., and the depth of both valves is 26 mm. A small individual measures 38 mm. in length, 20 mm. in height, and the depth of both valves is 18 mm.

This shell is much larger than the preceding species, the anterior end is more produced, and the valves are more gibbous.

Formation and locality. In the limestone of the Upper Helderberg group, Cayuga, Ontario.

MODIELLA, HALL. 1883.

MODIELLA PYGMÆA.

PLATE LXXVI, FIGS 9-20.

Pterinea pygmæa, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 251, pl. 13, fig. 15. 1842.
Cypricardinia pygmæa (CONRAD), S. A. MILLER. Cat. Am. Pal. Foss., p. 188. 1877.
Modiella pygmæa (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 76, figs. 9-20. 1883.

SHELL small, obliquely obovate; length one-third greater than the height. Basal margin arcuate anterior to the middle, broadly and distinctly curving to the post-inferior extremity. Posterior margin obliquely and broadly curved. Cardinal line distinctly arcuate, reaching beyond the middle of the length of the shell. Anterior end short, auriculate, limited by a depression extending from just anterior to the beak to the basal margin and producing a more or less distinct sinus.

Valves very convex in the middle and upper portions of the shell.

Beaks sub-anterior, small, closely appressed and incurved. Umbonal slope not distinctly limited, rather prominent, arcuate, extending to the post-inferior extremity. Along the middle of the cardinal slope there is sometimes a depression extending to the posterior margin.

Surface marked by fine concentric striæ, crossed by curving, radiating striæ which are more distinct on the body of the shell just posterior to the sinus. In well-preserved specimens the junctions of the radii with the concentric striæ are elevated into minute pustules.

Muscular impressions and pallial line distinctly marked. Hinge-line with a narrow groove posterior to the beaks.

Three specimens measure respectively 10, 14 and 15 mm. in length, and 7, 9.5 and 10 mm. in height.

The shell has the general form and external characters of a MODIOLA, with a constriction on the antero-basal margin indicating the place of a byssal sinus.

Formation and localities. In the shales of the Hamilton group at Pratt's falls, Onondaga county, and on the shores of Skaneateles, Otisco and Cayuga lakes, N. Y.

MEGAMBONIA, HALL. 1859.

MEGAMBONIA CARDIIFORMIS.

PLATE LII, FIGS. 1–8.

Pterinea cardiiformis, HALL. Geol. Rep. Fourth Dist. N. Y., p. 172, fig. 1. 1843.
Megambonia cardiiformis, HALL. Twelfth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 13. 1859.
" " " Pal. N. Y., vol. iii, p. 272. 1859.
" *subcardiformis*, " S. A. MILLER.* Cat. Am. Pal. Foss., p. 194. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations:* Pl. 52, figs. 1–8. 1883

SHELL large, cardiiform, higher than long; basal margin regularly rounded; posterior margin curving abruptly upward to the cardinal line; cardinal margin sub-alate posteriorly. Anterior end short, auriculate, separated from the body of the shell by a distinct byssal sinus, which is conspicuously marked in the margin of the shell.

Valves regularly convex, very gibbous in the umbonal region; the depth of the two valves is somewhat less than the length of the shell.

Beaks sub-anterior, incurved; umbo prominent, rising above the hinge-line.

Test thick, marked by concentric lamellæ of growth and by fine radiating striæ.

Anterior muscular impression large and deep, situated within the auricle and occupying a large part of the lobe. Posterior muscular impression large, situated near the post-cardinal extremity. There is an obscure indication of a lateral tooth on the post-cardinal angle.

A large and nearly perfect specimen has a length of 59 mm. and a height of 73 mm., with a depth to both valves of 46 mm. A larger specimen has a height of 76 mm. and a transverse diameter of 64 mm.

This species somewhat resembles *M. bellistriata* of the Oriskany sandstone, but differs in its greater gibbosity, shorter and more oblique sinus, separating the auricle.

Formation and locality. In the upper member of the Corniferous limestone at Clarence Hollow, Erie county, N. Y.

* The reference of this species under the specific name of *subcardiformis* has come from copying an erroneous manuscript record of the species.

AMNIGENIA, Hall. 1883.

Amnigenia Catskillensis.

PLATE XL, FIGS. 1-1; AND PLATE LXXX, FIG. 12.

Cypricardites Catskillensis, Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 186, t. 52, fig. 1. 1842.
Modiomorpha " " S. A. Miller. Cat. Am. Pal. Foss., p. 196. 1877.
Amnigenia " " Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 40, figs. 1-4; Pl. 80, fig. 12. 1883.
Cypricardites angustata, Vanuxem. Geol. Surv. N. Y., Rep. Third Dist., p. 186, t. 52, fig. 2. 1842.
Modiomorpha " " S. A. Miller. Cat. Am. Pal. Foss., p. 196. 1877.
Modiola angusta (Conrad, in error), Dana. Manual of Geology, p. 292, fig. 508. 1863.

Shell large, elongate-sub-elliptical or narrowly obovate, somewhat arcuate; length more than twice the height; basal margin often nearly straight, usually gently sinuate at about the anterior third and convex on the posterior half, sometimes gently convex for the entire length. Posterior extremity rounded, obliquely sub-truncate above from the extremity of the cardinal line. Cardinal line gently arcuate, rising from the beaks to beyond the middle of the shell, with a slight alation. Anterior end short, rounded.

Valves depressed-convex posteriorly, becoming convex in the middle and in the umbonal region.

Beaks sub-anterior, low, appressed, rising but little above the hinge-line. Umbonal slope convex, undefined, extending to the middle of the posterior extremity. Post-cardinal slope wide, not defined.

Surface marked by fine concentric striæ, which are often strongly fasciculate on the posterior, basal and anterior portions.

Anterior muscular impression large, strong, situated just anterior to the beaks and close beneath the upper margin of the shell. The left valve shows a double fold along the cardinal margin behind the beaks.

Three specimens measure respectively 105, 109 and 112 mm. in length, 40, 39 and 43 mm. in height at the beaks, and 47, 47 and 50 mm. in height at the posterior third. A large specimen has a length of 155 mm. and a height of 67 mm. A compressed specimen of the form described and figured by Vanuxem as *Cypricardites angustata*, measures 104 mm. in length,

24 mm. in height at the beaks, and 27 mm. in height near the posterior extremity. The various phases of this species seem to be all due to the degree and direction of pressure during the process of imbedding.

Formation and localities. In the Oneonta sandstone, at Mt. Upton, Chenango county; Gilbertsville, Otsego county; on the road from Jefferson to Gilboa, and at the base of the hills to the south of Jefferson, Schoharie county, N. Y. Prof. J. J. Stevenson has found a single valve of this fossil in the Catskill red sandstone on Wills creek, about one mile from Hyndman, and 1,600 feet above the base of the formation, in Bedford county, Pennsylvania. (Report T. 2, p. 103.)

This species is the only mollusk known in the Oneonta sandstone. At Mt. Upton it occurs in a shaly stratum associated with numerous plant remains. The bed containing the specimens of this species in great abundance is surmounted by at least five hundred feet of shales, alternating with bands of gray and reddish sandstones, containing great numbers of plant remains which have not been identified.

The relations of the Oneonta sandstone to the Hamilton and Chemung groups has heretofore been discussed,* and all subsequent studies of the localities in Delaware, Otsego and Chenango counties sustain the views published by me in 1870 and 1880. This deposit, consisting of red and gray compact or shaly sandstones, red and green marls, etc., comes in at about the close of the Hamilton period, or more properly may be regarded as the result of changes which terminated the conditions of the Hamilton group. The changes supervening in the east, at that time, seem to have affected the succeeding strata throughout the entire length of the State, although this particular portion of the series apparently merges into the succeeding Portage group, of which, farther west, it forms a part. The presence of numerous fragmentary and drifted land plants indicates the proximity of land, and in Schoharie county, just below the commencement of the red deposits, we find the trunks of two species of Psaronius, standing erect in the place and position in which they have grown, enveloped by an argillaceous sandstone with their bases resting upon and imbed-

*See Report upon the State Museum for 1870, and a paper read before the National Academy of Sciences in New York, 1880, of which an abstract was published in "Science," December 11, 1880.

ded in the underclay, showing that the ocean bed had been elevated above the sea level for a considerable period of time. This horizon is probably the equivalent of the lower part of the Oneonta series, and may be regarded as of Hamilton age. The influx of these shore deposits into an area occupied by marine sediments and a marine fauna has, for a considerable extent westward, and through a considerable time, broken the continuance of the marine fauna, though gradually mingling with the succeeding marine deposits in its western extension.

The Oneonta sandstone in Otsego and Chenango counties, is succeeded directly by strata bearing fossils of Chemung age, leaving no question as to its relations. All the more recent investigations serve to show that the views heretofore expressed regarding the position and relations of this formation are correct, and that properly it forms no part of the Catskill group, except so far as it is the result of similar conditions which were intermitted at the close of the Oneonta and resumed after the deposition of the Chemung sediments, and which may have once been continuous in some far easterly locality. Moreover, with our present knowledge, the higher beds of the Chemung, as known in the central and western portions of the State, have no considerable extension to the eastward. The fossils obtained on the western flank of the Catskill mountains are comparable with those of the middle portion of the group as developed in central New York. Thus far I am not aware that the Chemung group has been positively shown to exist on the eastern flank of the Catskills, and the rapid thinning of that formation to the eastward, as shown on the geological map, suggests the possibility of it having thinned out entirely before reaching the Hudson river valley.

Catskill group,
Chemung group,
Oneonta { Portage group,
Hamilton (Upper),
Hamilton group,
Corniferous limestone,
Oriskany sandstone.

SYNOPTICAL TABLE TO THE GENERA AND SPECIES DESCRIBED IN VOLUME V, PART I.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus	Hamilton.	Genesee slate	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
	1	**Aviculopecten,** McCoy. 1851.												
		Section a.												
1	1	A. princeps, Conrad,		*		*							1	I, figs. 10, 11; V, figs. 18, 19, 23, 24; VI, figs. 1–9; XXIV, fig. 7; LXXXI, figs. 13–17.
2	2	A. pecteniformis, Conrad,		*									4	I, fig. 9.
3	3	A. Cleon, Hall,		*									6	I, fig 1.
4	4	A. scabridus, Hall,				*							7	III. figs. 3–12.
5	5	A. exactus, Hall,				*							8	III, figs. 18–22.
6	6	A. formio, Hall,				*							9	V, figs. 20, 21.
7	7	A. Phorcus, Hall,				*							10	V, fig. 22.
8	8	A. fasciculatus, Hall,				*							11	V. figs. 9–17; LXXXI, figs. 1–4.
9	9	A. Idas, Hall,				*							13	III, figs. 1, 2; XXIV, fig. 4.
10	10	A. lautus, Hall,				*							14	III. figs. 16, 17; LXXXI, fig. 5.
11	11	A. rugæstriatus, Hall,							*				15	VII, figs. 8–11; LXXXI, figs. 11, 12.
12	12	A. duplicatus, Hall,							*				17	VII, figs. 1–7; LXXXI, figs. 9, 10.
13	13	A. cancellatus, Hall,							*				18	VII, figs. 12, 14–19.
14	14	A. æquilateralis, Hall,							*				19	LXXXII, fig. 1.
15	15	A. Itys, Hall,							*				20	VII, fig. 13.
16	16	A. plenus, Hall,							*				21	XXIV, fig. 3.
17	17	A. striatus, Hall,							*				22	X. figs 3, 4.
18	18	A. celsus, Hall,							*				23	VII, figs. 29, 30.
19	19	A. patulus, Hall,							*				24	VII figs. 32, 33.
20	20	A. ellipticus, Hall,							*				25	VII, fig. 31.
21	21	A. dolabriformis, Hall,							*				26	VII, fig. 21.
22	22	A. squama, Hall,							*				27	VII, fig. 20.
23	23	A. convexus, Hall,							*				28	VII, figs. 22, 23.
24	24	A. signatus, Hall,							*				29	VII, fig. 24.
25	25	A. Caroli, Winchell,									*		29	IX, fig. 5.
26	26	A. (Crenipecten ?) incultus, Hall,							*				30	IX, fig. 3.
27	27	A. (Pterinopecten ?) invalidus, Hall,			*								31	I, fig. 18; LXXXII, fig. 21.
28	28	A. (Pterinopecten ?) terminalis, Hall,		*									32	I, fig. 3.
		Section b.												
29	29	A. ignotus, Hall,		*									33	I, fig. 2.
30	30	A. insignis, Hall,				*							34	I, fig. 8; III, fig. 13; LXXXI, fig. 7.
31	31	A. bellus, Conrad,				*							35	II, figs. 5, 6, 9; LXXXI, fig. 8.
32	32	A. ornatus, Hall,				*							37	II, figs. 7, 8; III, fig. 14.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
33	33	A. mucronatus, Hall,	.	.	.	*	.	.	.	.	.	.	38	III, fig. 15.
34	34	A. tenuis, Hall,	.	.	.	.	.	.	*	.	.	.	39	VII, figs. 27, 28; LXXXI, fig. 6.
				5	1	12			16		1			
	2	**Lyriopecten,** Hall. 1877.												
35	1	L. parallelodontus, Hall,	*	.	.	.	.	.	.	.	.	.	40	IV, figs. 1, 2.
36	2	L. Dardanus, Hall,	.	*	.	.	.	.	.	.	.	.	41	I, fig. 5.
37	3	L. orbiculatus, Hall,	.	.	.	*	.	.	.	.	.	.	42	IV, figs. 3–8; LXXXII, fig. 3.
38	4	L. interradiatus, Hall,	.	.	.	*	.	.	.	.	.	.	44	II, figs. 1–4; LXXXII, fig. 5.
39	5	L. macrodontus, Hall,	.	.	.	*	.	.	.	.	.	.	46	IV, fig. 9; VIII, figs. 9, 10.
40	6	L. cymbalon, Hall,	.	.	.	*	.	.	.	.		.	47	XXIV, fig. 8.
41	7	L. tricostatus, Vanuxem,	.	.	.	.	.	.	*	.	.	.	48	IV, fig. 11; VII, fig. 26; X, figs. 6–12.
42	8	L. Polydorus, Hall,	.	.	.	.	.	.	*	.	.	.	50	VII, fig. 25.
43	9	L. magnificus, Hall,	.	.	.	.	.	.	*	.	.	.	51	VIII, fig. 8.
44	10	L. anomiæformis, Hall,	.	.	.	.	.	.	*	.	.	.	53	IV, fig. 10; X, fig. 5; LXXXII, fig. 2.
45	11	L. Priamus, Hall,	.	.	.	.	.	.	*	.	.	.	54	X, figs. 1, 2; LXXXII, fig. 6.
46	12	L. fasciatus, Hall,	.	.	.	.	.	.	*	.	.	.	55	IX, figs 10, 11.
47	13	L. solox, Hall,	.	.	.	.	.	.	*	.	.	.	56	XXIV, fig. 5.
			1	1		4			7					
	3	**Pterinopecten,** Hall. 1883.												
48	1	P. multiradiatus, Hall,	.	*	.	.	.	.	.	.	.	.	57	I, figs. 6, 7.
49	2	P. reflexus, Hall,	.	*	.	.	.	.	.	.	.	.	58	LXXXII, fig. 8.
50	3	P. insons, Hall,	.	*	.	.	.	.	.	.	.	.	59	I, fig. 4.
51	4	P. nodosus, Hall,	.	*	.	.	.	.	.	.	.	.	60	LXXXII, fig. 13.
52	5	P. exfoliatus, Hall,	.	.	*	.	.	.	.	.	.	.	61	I, figs. 16, 17; LXXXIII, figs. 6, 7.
53	6	P. dignatus, Hall,	.	.	*	.	.	.	.	.	.	.	62	I, figs. 12, 14, 15.
54	7	P. lætus, Hall,	.	.	*	.	.	.	.	.	.	.	63	I, fig. 13.
55	8	P. Hermes, Hall,	.	.	.	*	.	.	.	.	.	.	64	XVII, figs. 13–15.
56	9	P. spondylus, Hall,	.	.	.	*	.	.	.	.	.	.	65	XVII, fig. 16.
57	10	P. conspectus, Hall,	.	.	.	*	.	.	.	.	.	.	66	XVII, figs 17, 18, 20, 21.
58	11	P. filitextus, Hall,	.	.	.	*	.	.	.	.	.	.	67	XVII, fig. 22; LXXXII, figs. 9, 10.
59	12	P. intermedius, Hall,	.	.	.	*	.	.	.	.	.	.	68	XVII, fig. 19; LXXXIII, figs. 4, 5.
60	13	P. regularis, Hall,	.	.	.	*	.	.	.	.	.	.	70	LXXXIII, fig. 1.
61	14	P. Vertumnus, Hall,	.	.	.	*	.	.	.	.	.	.	71	V, figs. 1–8; LXXXIII, figs. 2, 3.
62	15	P. undosus, Hall,	.	*	.	*	.	.	.	.	.	.	72	II, figs. 10–19; LXXXII, fig. 7.
63	16	P. (Aviculopecten ?) strictus, Hall,	.	.	.	.	.	.	*	.	.	.	74	XXIV, fig. 2; LXXXII, fig. 18.
64	17	P. imbecilis, Hall,	.	.	.	.	.	.	*	.	.	.	75	XXIV, fig. 1.
65	18	P. dispandus, Hall,	.	.	.	.	.	.	*	.	.	.	76	LXXXII, figs. 11, 12.
66	19	P. erectus, Hall,	.	.	.	.	.	.	*	.	.	.	77	LXXXII, figs. 15–17.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.	Catskill.	Waverly.	Carboniferous.	Page.	Plates and Figs.
67	20	P. crenicostatus, Hall,	.	.	.	.	.	.	*	.	.	.	78	VIII, figs. 3, 4; LXXXII, fig. 14.
68	21	P. Neptunus, Hall,	.	.	.	.	.	.	*	.	.	.	79	VIII, figs 5–7.
69	22	P. suborbicularis, Hall,	.	.	.	.	.	.	*	.	.	.	80	VIII, figs. 1, 2; XXIV, fig. 10; LXXXII, fig. 4.
	4	**Crenipecten,** Hall. 1883.		5	3	8			7			.		
70	1	C. amplus, Hall,	.	.	.	.	.	.	*	.	.	.	81	IX, figs. 9, 13, 18.
71	2	C. crenulatus, Hall,	.	.	.	.	.	.	*	.	.	.	82	IX, figs. 6, 7, 8, 15, 16, 17.
72	3	C. impolitus, Hall,	.	.	.	.	.	.	*	.	.	.	83	IX, fig. 14; LXXXIII, fig. 10.
73	4	C. obsoletus, Hall,	.	.	.	.	.	.	*	.	.	.	84	IX, figs. 19, 21.
74	5	C. glaber, Hall,	.	.	.	.	.	.	*	.	.	.	85	IX, figs. 20, 22?
75	6	C. micropterus, Hall,	.	.	.	.	.	.	*	.	.	.	86	IX, fig. 23.
76	7	C. liratus, Hall,	.	.	.	.	.	.	*	.	.	.	87	IX fig. 24; LXXXIII, fig. 9.
77	8	C. Leon, Hall,	.	.	.	.	.	.	*	.	.	.	88	IX, fig. 12; LXXXIII, fig. 8.
78	9	C. Winchelli, Meek,	.	.	.	.	.	.	.	.	*	.	89	IX, figs. 1, 2, 4, 25–30.
	5	**Pterinea,** Goldfuss. 1826.							8		1			
79	1	P. grandis, n. sp.,	.	*	.	.	.	.	.	.	.	.	91	LXXXIII, fig. 14.
80	2	P. pinguis, Hall,	.	*	.	.	.	.	.	.	.	.	92	XV, figs. 2, 3; LXXXIII, fig. 13.
81	3	P. flabella, Conrad,	.	*	.	*	.	.	*	.	.	.	93	XIV, figs. 1–21; XV, figs. 1, 4–6, 8–10; LXXXIII, figs. 11, 12.
82	4	P. interstrialis, Hall,	.	.	.	.	.	.	*	.	.	.	96	LXXXIV, fig. 22.
83	5	P. dispanda, Hall,	.	.	.	.	.	.	*	.	.	.	97	XV, fig. 7.
84	6	P. Chemungensis, Conrad,	.	.	.	.	.	.	*	.	.	.	98	XVI, figs. 3, 7, 10, 12; LXXXIV, fig. 21.
85	7	P. consimilis, Hall,	.	.	.	.	.	.	*	.	.	.	100	XVI, figs. 1, 2, 8, 9, 11; LXXXIV, fig. 23.
86	8	P. rigida, Hall,	.	.	.	.	.	.	*	.	.	.	101	XVI, figs 5, 6.
87	9	P. prora, Hall,	.	.	.	.	.	.	*	.	.	.	102	XVI, figs. 4, 13, 14.
		s. g. *VERTUMNIA*, Hall. 1883.		3		1			7					
88	10	P. (Vertumnia) reversa, Hall,	.	.	.	.	.	.	*	.	.	.	104	XXIV, figs. 6, 12; LXXXIV, fig. 24.
89	11	P. (Vertumnia) avis, Hall,	.	.	.	.	.	.	*	.	.	.	105	XXIV, figs. 9, 11, 13.
90	12	P. (Vertumnia) reproba, Hall,	.	.	.	.	.	.	*	.	.	.	106	LXXXII, figs. 19, 20.
	6	**Actinopteria,** Hall. 1883.							3					
91	1	A. eximia, Hall,	*	.	.	.	.	.	.	.	.	.	107	XXV, fig. 1.
92	2	A. muricata, Hall,	.	.	*	.	.		.	.	.	.	108	XVII, figs. 1–3.
93	3	A. Doris, Hall,	.	.	*	.	.	.	.	.	.	.	109	XVII, fig. 4.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Scholarie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
94	4	A. subdecussata, Hall,	.	.	.	*	.	.	.	.	.	.	110	XVII, figs. 23, 25–27, 29–31; XIX, fig. 25.
95	5	A. decussata, Hall,	.	.	.	*	.	.	.	.	.	.	111	XVII, figs. 24, 28; XVIII, figs. 1–15; XX, fig. 19; LXXXIV, fig. 4.
96	6	A. Boydi, Conrad.	.		.	*	.	.	.	.	.	.	113	XIX, figs. 2–24, 26–30; LXXXIV, figs. 16, 17.
97	7	A. perobliqua, Conrad,	.	.	.	*	.	.	.	.	.	.	116	XIX, fig. 31; LXXXIV, fig. 14.
98	8	A. pusilla, Hall,	.	.	.	*	.	.	.	.	.	.	117	LXXXIV, fig 3.
99	9	A. perstrialis, Hall,	.	.	.	.	.	.	*	.	.	.	118	XXIII, figs. 2, 7; LXXXIV, fig. 12.
100	10	A. tenuistriata, Hall,	.	.	.	.	.	.	*	.	.	.	120	LXXXIV, figs. 5, 6.
101	11	A. auriculata, Hall,	.	.	.	.	.	.	*	.	.	.	121	LXXXIV, fig. 15.
102	12	A. delta, Hall,	.	.	.	.	.	.	*	.	.	.	121	XXXIII, fig. 3.
103	13	A. epsilon, Hall,	.	.	.	.	.	.	*	.	.	.	122	XXIII, figs. 4 (5, 6?), 8.
104	14	A. zeta, Hall,	.	.	.	.	.	.	*	.	.	.	123	XXIII, fig. 9; LXXXIV, figs. 1, 2.
105	15	A. eta, Hall,	.	.	.	.	.	.	*	.	.	.	124	LXXXIV, figs. 8–11.
106	16	A. theta, Hall,	.	.	.	.	.	.	*	.	.	.	125	LXXXIV, figs. 18, 19.
107	17	A. iota, Hall,	.	.	.	.	.	.	*	.	.	.	127	LXXXIV, fig. 7.
108	18	A. kappa, Hall,	.	.	.	.	.	.	*	.	.	.	128	LXXXIV, fig. 13.
			1		2	5			10					
	7	**Ptychopteria,** Hall. 1883.												
109	1	P. Proto, Hall,	.	.	.	.	.	.	*	.	.	.	129	XXIII, figs. 12, 14.
110	2	P. sinuosa, Hall.	.	.	.	.	.	.	*	.	.	.	130	XXIII, fig. 13; LXXXV, fig. 8.
111	3	P. Salamanca, Hall,	.	.	.	.	.	.	*	.	.	.	131	XXIII, figs. 17–20.
112	4	P. Sao, Hall,	.	.	.	.	.	.	*	.	.	.	132	XXIII, figs. 16, 23; LXXXV, figs. 14–18.
113	5	P. Eucrate, Hall,	.	.	.	.	.	.	*	.	.	.	133	XXIII, fig. 24; LXXXV, figs. 27, 28.
114	6	P. Thetis, Hall.	.	.	.	.	.	.	*	.	.	.	135	LXXXV, figs. 1–4.
115	7	P. falcata, Hall,	.	.	.	.	.	.	*	.	.	.	136	LXXXV, figs. 6, 7.
116	8	P. Spio, Hall,	.	.	.	.	.	.	*	.	.	.	137	LXXXV, fig. 19.
117	9	P. Eudora, Hall,	.	.	.	.	.	.	*	.	.	.	138	LXXXV, fig. 9.
118	10	P. alata, Hall,	.	.	.	.	.	.	*	.	.	.	139	XXIII, figs. 25, 26 (21, 22?); LXXXV, fig. 26.
119	11	P. trigonalis, Hall,	.	.	.	.	.	.	*	.	.	.	140	LXXXV, figs. 34, 35.
120	12	P. elongata, Hall,	.	.	.	.	.	.	*	.	.	.	141	LXXXV, figs. 10–13.
121	13	P. Galene, Hall,	.	.	.	.	.	.	*	.	.	.	142	LXXXV, figs. 29–31.
122	14	P. Beecheri, Hall,	.	.	.	.	.	.	*	.	.	.	143	LXXXV, figs. 21, 22.
123	15	P. spatulata, Hall,	.	.	.	.	.	.	*	.	.	.	144	LXXXV, fig. 20.
124	16	P. lata, Hall,	.	.	.	.	.	.	*	.	.	.	145	LXXXV, figs. 23–25.
125	17	P. perlata, Hall,	.	.	.	.	.	.	*	.	.	.	117	LXXXV, figs. 38, 39.
126	18	P. Thalia, Hall,	.	.	.	.	.	.	*	.	.	.	148	LXXXV, figs. 32, 33.
127	19	P. gibbosa, Hall,	.	.	.	.	.	.	*	.	.	.	149	LXXXV, fig. 5.
128	20	P. lobata, Hall,	.	.	.	.	.	.	*	.	.	.	150	LXXXV, fig. 37.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Scoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
129	21	P. Vanuxemi, Hall,	.	.	.	.	.	.	*	.	.	.	151	LXXXV, fig. 36.
130	22	P. expansa, Hall,	.	.	.	.	.	.	*	.	.	.	152	XXIII, figs. 10, 11.
									22					
	8	**Glyptodesma,** Hall. 1883.												
131	1	G. erectum, Conrad,	.	.	.	*	.	.	.	.	.	.	153	XI, figs. 1-10; XII, figs. 1-3, 5-9; XIII, figs. 1-4, 12-15; XXV, figs. 14-17; LXXXVI, figs. 1-8; LXXXVII, figs. 1-3.
132	2	G. erectum, var. obliquum, Hall,	.	.	.	*	.	.	.	.	.	.	155	XII, fig. 4; XIII, figs. 5-11.
133	3	G. occidentale, Hall,	.	*	.	.	.	.	.	.	.	.	157	XV, fig. 12; LXXXVI, fig. 9.
				1		2								
	9	**Leiopteria,** Hall. 1877.												
134	1	L. lævis, Hall,	.	.	*	.	.	.	.	.	.	.	158	XVII, figs 5-11; XX, fig. 5.
135	2	L Conradi, Hall,	.	.	.	*	.	.	.	.	.	.	159	XX, figs. 1, 2, 4; LXXXVIII, figs. 1-4.
136	3	L. Greeni, Hall,	.	.	.	*	.	.	.	.	.	.	160	XX, figs. 9, 12; LXXXVIII, figs. 21, 22.
137	4	L. Rafinesquii, Hall,	.	*	.	*	.	.	.	.	.	.	161	XV, fig. 11; XX, figs. 6, 7; LXXXVIII, figs. 27, 28.
138	5	L. Sayi, Hall,	.	.	.	*	.	.	.	.	.	.	162	LXXXVIII, figs. 15-20.
139	6	L. De Kayi, Hall,	.	.	.	*	.	.	.	.	.	.	164	XIX, fig. 1; XX, figs. 16-18; LXXXVIII, figs. 5-10.
140	7	L. Bigsbyi, Hall,	.	.	.	*	.	.	.	.	.	.	165	XX, figs. 3, 11, 13-15; LXXXVIII, fig. 23.
141	8	L. Mitchelli, Hall,	.	.	.	*	.	.	.	.	.	.	166	XX, fig. 8; LXXXVIII, fig. 26.
142	9	L. Troosti, Hall,	.	.	.	*	.	.	.	.	.	.	167	LXXXVIII, figs. 12, 13.
143	10	L. Leai, Hall,	.	.	.	*	.	.	.	.	.	.	168	LXXXVIII, figs. 24, 25.
144	11	L. Gabbi, Hall,	.	.	.	*	.	.	.	.	.	.	169	LXXXVIII, fig. 14.
145	12	L. Oweni, Hall,	.	.	.	*	.	.	.	.	.	.	170	XX, fig. 10.
146	13	L. Chemungensis, Vanuxem,	.	.	.	.	.	.	*	.	.	.	172	XXII, figs. 17, 18.
147	14	L. linguiformis, Hall,	.	.	.	.	.	.	*	.	.	.	173	LXXXVIII, fig. 29.
148	15	L. Torreyi, Hall,	.	.	.	.	.	.	*	.	.	.	174	XXII, figs. 6, 7; LXXXVIII, fig. 11.
				1	1	11			3					
	10	**Leptodesma,** Hall. 1883.												
		a, spinifera.												
149	1	L. Marcellense, Hall,	.	.	*	.	.	.	.	.	.	.	175	XVII, fig. 12.
150	2	L Rogersi, Hall,	.	.	.	*	.	.	.	.	.	.	176	XXI, figs. 1-9.
151	3	L. spinigerum, Conrad,	.	.	.	.	.	.	*	.	.	.	177	XXI, figs. 10-13; LXXXIX, fig. 1.
152	4	L. longispinum, Hall,	.	.	.	.	.	.	*	.	.	.	179	XXI, figs 14, 17-19; LXXXIX, figs. 2-4.
153	5	L. Shumardi, Hall,	.	.	.	.	.	.	*	.	.	.	180	LXXXIX, figs. 5, 6.
154	6	L. robustum, Hall,	.	.	.	.	.	.	*	.	.	.	181	XXI, figs. 15, 16, 20; LXXXIX, fig. 8.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
155	7	L. Agassizi, Hall,	.	.	.	.	.	.	*	.	.	.	182	LXXXIX, figs. 17–19.
156	8	L. protextum, Conrad,	.	.	.	.	.	.	*	.	.	.	183	XXI, figs. 22, 23.
157	9	L. Becki, Hall,	.	.	.	.	.	.	*	.	.	.	185	XXII, figs. 3–5.
158	10	L. disparile, Hall,	.	.	.	.	.	.	*	.	.	.	186	XXV, figs. 2–4; LXXXIX, figs. 23, 24.
159	11	L. sociale, Hall,	.	.	.	.	.	.	*	.	.	.	187	XXI, figs. 24–28, (33, 34 ?)
160	12	L. potens, Hall,	.	.	.	.	.	.	*	.	.	.	188	XXI, figs. 21, 30; XXII, figs. 11, 12, 19, (20 ?), 21; LXXXIX, fig. 7.
161	13	L. potens, var. juvens, Hall,	.	.	.	.	.	.	*	.	.	.	189	XXII, fig. 16.
162	14	L. Mortoni, Hall,	.	.	.	.	.	.	*	.	.	.	190	XXI, figs. 29, 31, 32; LXXXIX, figs. 9–11.
163	15	L. Billingsi, Hall,	.	.	.	.	.	.	*	.	.	.	192	LXXXIX, figs. 12–15.
164	16	L. Matheri, Hall,	.	.	.	.	.	.	*	.	.	.	193	XXII, figs. 8, 9, 10; LXXXIX, fig. 25.
165	17	L. Spephani, Hall,	.	.	.	.	.	.	*	.	.	.	194	LXXXIX, figs. 20–22
166	18	L. lepidum, Hall,	.	.	.	.	.	.	*	.	.	.	195	XXI, fig. 40; LXXXIX, fig. 16.
167	19	L. curvatum, Hall,	.	.	.	.	.	.	*	.	.	.	196	XXV, fig. 5.
		b, umbonata.												
168	20	L. Medon, Hall,	.	.	.	.	.	.	*	.	.	.	197	XC, figs. 1–4.
169	21	L. umbonatum, Hall,	.	.	.	.	.	.	*	.	.	.	198	XXII, fig. 13; XC, fig. 9.
170	22	L. umbonatum, var. depressum, Hall,	.	.	.	.	.	.	*	.	.	.	199	XXII, fig 14; XC, fig. 10.
171	23	L. naviforme, Hall,	.	.	.	.	.	.	*	.	.	.	200	XXII, fig. 15; XXIII, fig. 1.
172	24	L. Cadmus, Hall,	.	.	.	.	.	.	*	.	.	.	201	XC, figs. 6, 7.
173	25	L. Creon, Hall,	.	.	.	.	.	.	*	.	.	.	202	XC, figs. 11–13.
174	26	L. Demus, Hall,	.	.	.	.	.	.	*	.	.	.	203	XC, figs. 15, 16.
175	27	L. Loxias, Hall,	.	.	.	.	.	.	*	.	.	.	204	XC, fig 14.
176	28	L. Mentor, Hall,	.	.	.	.	.	.	*	.	.	.	205	XC, fig. 5; XXIII, fig. 15 ?
177	29	L. Orodes, Hall,	.	.	.	.	.	.	*	.	.	.	206	XXV, figs. 6, 9, (10 ?); XC, fig. 8.
		c, rostrata.												
178	30	L. extennatum, Hall,	.	.	.	.	.	.	*	.	.	.	207	XXII, fig 23; XC, figs. 17, 18.
179	31	L. Hector, Hall,	.	.	.	.	.	.	*	.	.	.	209	XC, figs. 19, 20.
180	32	L. Clitus, Hall,	.	.	.	.	.	.	*	.	.	.	210	XC, fig. 21.
181	33	L. truncatum, Hall,	.	.	.	.	.	.	*	.	.	.	211	XC, figs. 24, 25.
182	34	L. Corydon, Hall,	.	.	.	.	.	.	*	.	.	.	212	XC, fig. 22.
183	35	L. Jason, Hall,	.	.	.	.	.	.	*	.	.	.	213	XCI, figs. 4–6.
184	36	L. Pelops, Hall,	.	.	.	.	.	.	*	.	.	.	214	XC, figs. 28, 29.
185	37	L. Orcus, Hall,	.	.	.	.	.	.	*	.	.	.	215	XC, fig. 23.
186	38	L. Lysander, Hall,	.	.	.	.	.	.	*	.	.	.	216	XXII, fig. 22; XC, fig. 34.
187	39	L. Nereus, Hall,	.	.	.	.	.	.	*	.	.	.	217	XC, figs. 31–33.
188	40	L. alatum, Hall,	.	.	.	.	.	.	*	.	.	.	218	XC, figs. 26, 27.
189	41	L. Orus, Hall,	.	.	.	.	.	.	*	.	.	.	219	XC, fig. 30.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Cornliferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
190	42	L. aliforme, Hall,	.	.	.	.	.	.	*	.	.	.	220	XXII, fig. 28; XCI, fig. 2.
191	43	L. rude, Hall,	.	.	.	.	.	.	*	.	.	.	221	XXV, fig. 12; XCI, fig. 3.
192	44	L. Biton, Hall,	.	.	.	.	.	.	*	.	.	.	222	XCI, fig. 1.
193	45	L. Lesleyi, Hall,	.	.	.	.	.	.	*	.	.	.	223	XCI, fig. 7.
194	46	L. aviforme, Hall,	.	.	.	.	.	.	*	.	.	.	224	XCI, fig. 8.
		d, patulata.												
195	47	L. flaccidum, Hall,	.	.	.	.	.	.	*	.	.	.	225	XCI, fig. 9.
196	48	L. patulum, Hall,	.	.	.	.	.	.	*	.	.	.	226	XCI, figs. 10, 11.
197	49	L. complanatum, Hall,	.	.	.	.	.	.	*	.	.	.	227	XXII, fig. 2.
		e, arcoidea.												
198	50	L. Maclurii, Hall,	.	.	.	.	.	.	*	.	.	.	228	XXV, figs. 8, 13; XCI, figs. 13, 14.
199	51	L. arciforme, Hall,	.	.	.	.	.	.	*	.	.	.	229	XCI, fig. 12.
200	52	L. Phaon, Hall,	.	.	.	.	.	.	*	.	.	.	230	XCI, fig. 18.
201	53	L. propinquum, Hall,	.	.	.	.	.	.	*	.	.	.	231	XCI, figs. 16, 17.
202	54	L. Lichas, Hall,	.	.	.	.	.	.	*	.	.	.	232	XXI, figs. 35–39; XCI, figs. 19, 20.
203	55	L. quadratum, Hall,	.	.	.	.	.	.	*	.	.	.	233	XCI, fig. 15.
		f, mytiloidea.												
204	56	L. acutirostrum, Hall,	.	.	.	.	.	.	*	.	.	.	234	XCI, fig. 21.
205	57	L. mytiliforme, Hall,	.	.	.	.	.	.	*	.	.	.	235	XXV, figs 7, 11; XCI, figs. 22–25.
					1	1			55					
	11	**Pteronites,** McCoy. 1844.												
206	1	P. profundus, Hall,	.	.	.	.	.	.	*	.	.	.	237	XXII, figs. 25–27.
207	2	P. rostratus, Hall,	.	.	.	.	.	.	*	.	.	.	238	XXII, fig. 24.
208	3	P. inoptatus, Hall,	.	.	.	.	.	.	*	.	.	.	239	LXXXVII, fig. 5.
									3					
	12	**Palæopinna,** Hall. 1883.												
209	1	P. flabella, Hall, . Oriskany Sand.	.	.	.	.	.	.	.	.	.	.	240	XXV, fig. 18; LXXXVII, fig. 4.
210	2	P. recurva, Hall,	.	*	.	.	.	.	.	.	.	.	241	XXV, fig. 19.
				1										
	13	**Ectenodesma,** Hall. 1883.												
211	1	E. birostratum, Hall,	.	.	.	.	.	.	*	.	.	.	242	XXIII, figs. 27–30; LXXXIV, fig. 20.
									1					

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
	14	**Limoptera**, Hall. 1870.												
212	1	L. pauperata, Hall,	.	*	.	.	.	.	.	.	.	.	243	XXVI, fig. 5.
213	2	L. cancellata, Hall,	.	.	.	*	.	.	.	.	.	.	244	XXVI, figs. 1–4; XCII, figs. 1-3.
214	3	L. macroptera, Conrad,	.	.	.	*	.	.	.	.	.	.	246	XXIV, fig. 14; XXVI, figs. 6–9; XXVII, figs. 1–10; XXVIII, figs. 4, 5; XXIX, figs. 1–4; XCII, figs. 4–9.
215	4	L. obsoleta, Hall,	.	.	.	*	.	.	.	.	.	.	249	XXIX, figs. 5, 6; XXVI, fig. 10?; XCII, fig. 10.
216	5	L. curvata, Hall,	.	.	.	*	.	.	.	.	.	.	250	XXVIII, figs. 1–3.
				1		4								
	15	**Byssopteria**, Hall. 1883.												
217	1	B. radiata, Hall,	.	.	.	.	.	.	*	.	.	.	252	XXXII, figs. 21, 22; LXXX, fig. 11.
									1					
	16	**Mytilarca**, Hall. 1870.												
		s. g. *PLETHOMYTILUS*, Hall. 1883.												
218	1	M. (Plethomytilus) arenacea, Hall,	*	.	.	.	.	.	.	.	.	.	253	XXX, fig. 1; LXXXVII, fig. 10.
219	2	M. (Plethomytilus) ponderosa, Hall,	.	*	.	.	.	.	.	.	.	.	254	XXX, figs. 2–7.
220	3	M. (Plethomytilus) oviformis, Conrad,	.	.	.	*	.	.	.	.	.	.	255	XXXI, figs. 1–8; LXXXVII, fig. 8.
221	4	M. (Plethomytilus) Knappi, Hall,	.	.	.	*	.	.	.	.	.	.	256	LXXXVII, fig. 13.
222	5	M. pyramidata, Hall,	*	.	.	.	.	.	.	.	.	.	256	LXXX, figs. 1–3.
223	6	M. umbonata, Hall,	.	.	.	.	.	.	*	.	.	.	257	XXXII, figs. 1–7.
224	7	M. Chemungensis, Conrad,	.	.	.	.	.	.	*	.	.	.	258	XXXII, figs. 8–11, 13, 14.
225	8	M. carinata, Hall,	.	.	.	.	.	.	*	.	.	.	259	XXXII, figs. 15–19; XXXIII, fig. 8.
226	9	M. regularis, Hall,	.	.	.	.	.	.	*	.	.	.	260	XXXII, fig. 12.
227	10	M. attenuata, Hall,	.	.	.	.	.	.	*	.	.	.	260	XXXII, fig. 20.
228	11	M. simplex, Hall,	.	.	.	.	.	.	*	.	.	.	261	XXXIII, figs. 19, 21.
229	12	M. gibbosa, Hall,	.	.	.	.	.	.	*	.	.	.	262	XXXIII, fig. 20; LXXXVII, fig. 7.
230	13	M. lata, Hall,	.	.	.	.	.	.	*	.	.	.	262	XXXIII, fig. 22.
231	14	M. occidentalis, White and Whitfield,	.	.	.	.	.	.	.	.	*	.	263	XXXIII, figs. 3–5; LXXXVII, fig. 11.
232	15	M. fibristriata, White and Whitfield,	.	.	.	.	.	.	.	.	*	.	264	XXXIII, figs 6, 7; LXXXVII, fig. 6.
			2	1		2			8		2			
	17	**Gosselettia**, Barrois. 1881.												
233	1	G. triquetra, Conrad,	.	.	.	*	.	.	.	.	.		265	XXXI, figs. 9–17; LXXXVII, fig. 12.
234	2	G. retusa, Hall,	.	.	.	*	.	.	.	.	.	.	266	XXXIII, figs. 1, 2.
						2								

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
	18	**Modiola,** Lamarck. 1801.												
		s. g. *MYTILOPS*, Hall. 1870.												
235	1	M. (Mytilops) præcedens, Hall, . .	.	.	.	.	.	.	*	.	.	.	267	XXXIII, figs. 9–18.
236	2	M (Mytilops) metella, ...	.	.	.	.	.	.	*	.	.	.	268	XXXIII, figs. 23, 24; LXXXVII, fig. 9.
									2					
	19	**Modiomorpha,** Hall.												
237	1	M. Schoharie, Hall, ...	*	.	.	.	.	.	.	.	.	.	269	XXXIV, fig. 13; XXXV, fig. 14.
238	2	M. regularis, n. sp., ...	*	.	.	.	.	.	.	.	.	.	270	XXXV, fig. 12.
239	3	M. putillus, Hall, ...	*	.	.	.	.	.	.	.	.	.	271	XLI, figs. 1, 2.
240	4	M. ponderosa, Hall, ...	.	*	.	.	.	.	.	.	.	.	271	XXXIV, figs. 11, 12; XXXV, fig. 8.
241	5	M. complanata, Hall, ...	.	*	.	.	.	.	.	.	.	.	272	XXXIV, fig. 14; XLI, fig. 3.
242	6	M. Clarens, n. sp., ...	.	*	.	.	.	.	.	.	.	.	273	XLI, fig. 4.
243	7	M. linguiformis, Hall, ...	.	*	.	.	.	.	.	.	.	.	274	XXXIV, figs. (15 ?), 16, 17.
244	8	M. concentrica, Conrad, ...	.	.	.	*	.	.	.	.	.	.	275	XXXIV, figs. 9, 10; XXXV, figs. 1–5; XXXVI, figs. 1–16, (17, 18 ?)
245	9	M. mytiloides, Conrad, ...	.	.	.	*	.	.	.	.	.	.	277	XXXVII, fig. 3; XXXVIII, figs. 1–16.
246	10	M. alta, Conrad, ...	.	.	*	*	.	.	.	.	.	.	278	XXXVII, figs. 1, 2, (4, 5, 6 ?), 7–12, 15, 16; LXXX, fig. 7.
247	11	M. macilenta, Hall, ...	.	.	.	*	.	.	.	.	.	.	280	XXXVII, fig. 17; XXXIX, figs. 17–21.
248	12	M. arcuata, Hall, ...	.	.	.	*	.	.	.	.	.	.	281	XXXVI, fig. 21.
249	13	M. cymbula, Hall, ...	.	.	.	*	.	.	.	.	.	.	282	XXXVI, figs. 19, 20.
250	14	M. subalata, Conrad, ...	.	.	.	*	.	.	.	.	.	.	283	XXXV, figs. 6, 7; XXXIX, figs. 1–14, 16.
251	15	M. subalata, var. Chemungensis, n. var.	.	.	.	.	.	.	*	.	.	.	284	XLI, figs. 5, 6, 8, 9, 11, (7, 10 ?); XXXIX, fig. 15.
252	16	M. affinis, n. sp., ...	.	.	.	*	.	.	.	.	.	.	284	XXXVII, figs. 13, 14; XXXV, fig. 13.
253	17	M. recta, n. sp., ...	.	*	.	*	.	.	.	.	.	.	286	XXXV, fig. 9.
254	18	M. subangulata, n. sp., ...	.	.	.	.	.	.	*	.	.	.	287	XXXV, figs. 10, 11.
255	19	M. rigida, Hall, ...	.	.	.	.	.	.	*	.	.	.	287	XLI, figs. 14–16.
256	20	M. recurva, Hall, ...	.	.	.	.	.	.	*	.	.	.	288	XLI, fig. 17.
257	21	M. quadrula, Hall, ...	.	.	.	.	.	.	*	.	.	.	289	XLI, figs. 18–26.
258	22	M. neglecta, Hall, ...	.	.	.	.	.	.	*	.	.	.	290	XLI, fig. 13.
259	23	M. Tioga, n. sp , ...	.	.	.	.	.	.	*	.	.	.	291	XL, fig. 18.
260	24	M. hyalea, Hall, ...	.	.	.	.	.	.	.	.	*	.	292	XLI, figs. 28–30.
			3	5	1	9			7		1			
	20	**Goniophora,** Phillips. 1848.												
261	1	G. perangulata, Hall, ...	*	.	.	.	.	.	.	.	.	.	293	XXXIV, figs. 1–6; XLII, figs. 1, 2.
262	2	G. ? alata, n. sp., ...	*	.	.	.	.	.	.	.	.	.	294	XXXIV, fig. 7; XLII, fig. 3.
263	3	G. acuta, Hall, ...	.	.	.	*	.	.	.	.	.	.	295	XLIII, figs. 1–3.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Scholarie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
264	4	G. Hamiltonensis, Hall,	.	.	.	*	.	.	.	.	.	.	296	XLIII, figs. 8–15, 17–21.
265	5	G. rugosa, Conrad,	.	.	.	* *	.	.	.	.	.	.	297	XLII. figs. 7, 8*a*; XLIII, figs. 4–7.
266	6	G. truncata, Hall,	.	.	.	* *	.	.	.	.	.	.	298	XLII, figs. 9, 10; XLIV, figs. 1–5.
267	7	G. glaucus, Hall,	.	.	.	* *	.	.	.	.	.	.	299	XLIII, fig. 16; XLIV, figs. 10–17.
268	8	G. Ida, Hall,	.	.	.	* *	.	.	.	.	.	.	300	XLII, fig. 13; LXV, fig. 20.
269	9	G. carinata, Conrad,	.	.	.	* *	.	.	.	.	.	.	301	XLII, fig. 11; XLIV, figs. 6–8.
270	10	G. trigona, n. sp.,	.	.	.	.	.	.	*	.	.	.	302	XLII, fig 12; XLIV, fig. 9.
271	11	G. Chemungensis, Vanuxem,	.	.	.	.	.	.	* *	.	.	.	303	XLIV, figs. 18, 20, 22.
272	12	G. subrecta, n. sp.,	.	.	.	.	.	.	* *	.	.	.	304	XLII, figs. 14, 15; XLIV, figs. 19, 21.
273	13	G. minor, n. sp.,	.	.	.	.	.	.	*	.	.	.	305	XLII, figs. 4–6.
	21	**Microdon,** Conrad. 1842.	2			7			4					
		CYPRICARDELLA, Hall. 1858.												
274	1	M. (C.) major. n. sp.,	.	*	.	.	.	.	.	.	.	.	307	XLII, fig. 21.
275	2	M. (C.) bellistriatus, Conrad,	.	.	.	*	.	.	*	.	.	.	308	XLII, figs. 17–20; LXXIII, figs. 7–22; LXXIV, figs. 5–10.
276	3	M. (C.) gregarius, Hall,	.	.	.	*	.	.	*	.	.	.	309	LXXIII, figs. 1–6; LXXIV, figs. 1–4.
277	4	M. (C.) tenuistriatus, Hall,	.	.	.	*	.		.	.	.	.	310	XLII, fig. 16; LXXIII, figs. 23–30; LXXIV, figs. 20, 21.
278	5	M. (C.) complanatus, Hall,	.	..	.	*	.	.	.	.	.	.	311	XLII, fig. 22; LXXIV, figs. 14–19.
279	6	M. (C.) reservatus, Hall,	.	.	.	.	.	.	.	.	*	.	312	LXXIV, figs. 11–13.
				1		4			2		1			
	22	**Nucula,** Lamarck. 1799.												
280	1	N. niotica, Hall and Whitfield,	.	.	.	*	.	.	.	.	.	.	313	XLV, figs. 1, 2.
281	2	N. Neda, Hall and Whitfield,	.	.	.	*	.	.	.	.	.	.	314	XLV, figs. 3, 4.
282	3	N Randalli. Hall,	.	.	.	*	.	.	.	.	.	.	315	XLV, figs. 6–10, 16, 23, 26, 27; XCIII, figs. 1–3.
283	4	N. lirata, Conrad,	.	.	.	*	.	.	.	.	.	.	316	XLV, figs. 5, 11, 15, 17–22, 24, 25; XCIII, fig. 5.
284	5	N. subelliptica, Hall,	.	.	.	*	.	.	.	.	.	.	317	XLV, fig. 28.
285	6	N. bellistriata, Conrad,	.	.	.	*	.	.	.	.	.	.	318	XLVI, figs. 1–9.
286	7	N. varicosa, Hall,	.	.	.	*	.	.	.	.	.	.	319	XLVI, figs. 12–23; XCIII, fig. 4.
287	8	N. corbuliformis,	.	.	.	*	.	.	*	.	.	.	319	XLVI, figs. (10, 11 ?), 24–34, (35, 36, 37 ?).
288	9	N. lamellata, Hall,	.	.	.	*	.	.	*	.	.	.	320	LI. figs. 18–21; XLV, fig. 13; XCIII, fig. 7.
289	10	N. umbonata, Hall,	.	.	.	.	.	.	*	.	.	.	321	XLVII, figs. 51, 52.
290	11	N. diffidens, n. sp.,	.	.	.	.	.	.	*	.	.	.	322	XLV, figs. 12, 14.
291	12	N. globularis, n. sp.,	.	.	.	.	.	.	*	.	.	.	322	XCIII, fig. 6.
292	13	N. Houghtoni, Stevens,	.	.	.	.	.	.	.	.	*	.	323	XLV, figs. 29–31.
						9			5		1			

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Wavorly.†	Carboniferous.	Page.	Plates and Figs.
	23	**Nuculites,** Conrad. 1841.			1	4								
293	1	N. oblongatus, Conrad,	.	.	.	*	.	.	.	.	.	.	324	XLVII, figs. 1–12.
294	2	N. cuneiformis, Conrad,	.	.	.	*	.	.	.	.	.	.	325	XLVII, figs. 13–16.
295	3	N. triqueter, Conrad,	.	.	*	*	.	.	.	.	.	.	326	XLVII, figs 17–28; XCIII, figs. 8–10.
296	4	N. Nyssa, Hall,	.	.	.	*	.	.	.	.	.	.	328	XLVII, figs. 29, 30.
	24	**Leda,** Schumacher. 1817.				4					1			
297	1	L. diversa, Hall,	.	.	.	*	.	.	.	.	.	.	329	XLVII, figs. 31–37.
298	2	L. brevirostris, Hall,	.	.	.	*	.	.	.	.	.	.	329	XLVII, figs. 38–41.
299	3	L. rostellata, Conrad,	.	.	.	*	.	.	.	.	.	.	330	XLVII, figs. 42–47.
300	4	L. obscura, n. sp.,	.	.	.	*	.	.	.	.	.	.	331	XLVII, fig. 48.
301	5	L. pandoriformis, Stevens,	.	.	.	.	.	.	.	.	*	.	332	XLVII, figs. 49, 50.
	25	**Palæoneilo,** Hall. 1870.				4					1			
302	1	P. constricta, Conrad,	.	.	.	*	.	*	*	.	.	.	333	XLVIII, figs. 1–16; LI, fig. 17.
303	2	P. constricta, var. flexuosa, Hall,	.	.	.	.	.	.	*	.	.	.	334	XLVIII, figs. 17–20.
304	3	P. plana, Hall,	.	.	.	*	.	.	*	.	.	.	334	XLVIII, figs. 21–28.
305	4	P. maxima, Conrad,	.	.	.	*	.		.	.	.	.	335	XLVIII, figs. 29–38.
306	5	P. tenuistriata, Hall,	.	.	.	*	.	.	.	.	.	.	336	XLIX, figs. 1–12, 14; XCIII, fig. 13.
307	6	P. fecunda, Hall,	.	.	.	*	.	.	.	.	.	.	336	XLIX, figs. 13, 15–24.
308	7	P. muta, Hall,	.	.	.	*	.	.	.	.	.	.	337	XLIX, figs. 25–32.
309	8	P. emarginata, Conrad,	.	.	.	*	.	.	*	.	.	.	338	L, figs. 1–11.
310	9	P. perplana, Hall,	.	.	.	*	.	.	.	.	.	.	339	L, figs. 15–22; XCIII, fig. 12.
311	10	P. Virginica, n. sp.,	.	.	.	*	.	.	.	.	.	.	340	XCIII, fig. 14.
312	11	P. arata, Hall,	.	.	.	*	.	.	.	.	.	.	341	L, fig. 23.
313	12	P. brevis, Hall,	.	.	.	.	.	.	*	.	.	.	342	L, figs. 24–33.
314	13	P. filosa, Conrad,	.	.	.	.	.	.	*	.	.	.	343	XLIX, figs. 33–38.
315	14	P. angusta, n. sp.,	.	.	.	.	.	.	*	.	.	.	344	XCIII, fig. 11.
316	15	P. bisulcata, Hall,	.	.	.	.	.	.	*	.	.	.	344	L, figs. 12–14.
317	16	P. elongata, Hall,	.	.	.	.	.	.	*	.	.	.	345	XLVIII, fig. 39; XCIII, fig. 11*a*.
318	17	P. attenuata, Hall,	.	.	.	.	.	.	.	.	*	.	346	L, figs. 34–39.
319	18	P. truncata, Hall,	.	.	.	.	.	.	.	.	*	.	347	L, figs. 40, 41.
320	19	P. sulcatina, Conrad,	.	.	.	.	.	.	.	.	*	.	347	L, figs. 42–46.
321	20	P. ? dubia, n. sp.,	.	*	.	.	.	.	.	.	.	.	348	XCIII, fig. 15.
	26	**Macrodon,** Lycett. 1885.		1		10		1	9		3			
322	1	M. Hamiltoniæ, Hall,	.	.	.	*	.	.	.	.	.	.	349	LI, figs. 1–7, 9, 10.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
323	2	M. Chemungensis, Hall,	.	•	.	.	.	.	*	.	.	.	350	LI, figs. 11–16.
324	3	M. ovatus, Hall,	.	.	.	.	.	.	.	.	*	.	351	LI, fig. 8; XCIII, fig. 16.
						1			1		1			
	27	**Ptychodesma,** Hall and Whitfield. 1872.												
325	1	P. Knappianum, Hall and Whitfield,	.	.	.	*	.	.	.	.	.	.	352	LI, figs. 22–27.
326	2	P. minor, Hall,	.	.	.	.	.	.	*	.	.	.	353	XLI, fig. 27.
327	3	P. nanum, n. sp.,	.	.	.	.	.	.	*	.	.	.	353	XCIII, figs. 17, 18
						1			2					
	28	**Nyassa,** Hall. 1870.												
328	1	N. arguta, Hall,	.	.	.	*	.	.	.	.	.	.	354	LIII, figs. 7–20.
329	2	N. subalata, Hall,	.	.	.	*	.	.	.	.	.	.	355	LIII, figs. 21–26.
330	3	N. recta, Hall,	.	.	.	*	.	.	.	.	.	.	356	LIII, figs. 1–6.
331	4	N. elliptica, Hall,	.	*	.	.	.	.	.	.	.	.	357	XXXIV, fig. 8.
				1		3								
	29	**Grammysia,** De Verneuil. 1847.												
		a. cingulata.												
332	1	G. ovata, n. sp.,	.	*	.	.	.	.	.	.	.	.	358	XCIII, fig. 22.
333	2	G. bisulcata, Conrad,	.	.	.	*	.	.	.	.	.	.	359	LIV, figs. 1–16; LVI, fig. 1; XCIII, fig. 25.
334	3	G. nodocostata, Hall,	.	.	.	*	.	.	.	.	.	.	360	LV, figs. 1–11; LVI, figs. (2, 3 ?); LVII, figs. 7, 8; XCVI, figs. 19–21.
335	4	G. magna, Hall,	.	.	.	*	.	.	*	.	.	.	362	LVI, figs. 4–7; LVII, fig. 9.
336	5	G. erecta, Hall,	.	.	.	*	.	.	.	.	.	.	363	LVI, fig. 8; LVII, fig. 10.
337	6	G. circularis, Hall,	.	.	.	*	.	.	*	.	.	.	364	LVII, figs. 3–6; LVIII, fig. 13.
338	7	G. elliptica, Hall,	.	.	.	.	.	.	*	.	.	.	365	LVIII, figs. 1–12, (1, 5, 6 ?).
		b. obsoleta.												
339	8	G. obsoleta, Hall.	.	.	.	*	.	.	.	.	.	.	366	LIX, figs. 21–27.
340	9	G. bellatula, Hall,	.	.	.	*	.	.	.	.	.	.	367	LXIII, 1–3.
341	10	G. Eriopia, Hall,	.	.	.	*	.	.	.	.	.	.	368	LXIII, figs. 7, 8.
342	11	G. glabra, n. sp.,	.	.	.	.	.	.	*	.	.	.	369	XCIII, fig. 24.
		c. undulata.												
343	12	G. alveata, Conrad,	.	.	.	*	.	.	.	.	.	.	370	LVII, figs. 1, 2; LX, figs. 1–11.
344	13	G. lirata, Hall,	.	.	.	*	.	.	.	.	.	.	371	LIX, figs. 6–12.
345	14	G. globosa, Hall,	.	.	.	*	.	.	.	.	.	.	372	LXII, figs. 10–19.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
346	15	G. zonata, Hall,	.	.	.	*	.	.	.	.	.	.	373	LXIII, figs. 4, 5.
347	16	G. arcuata, Conrad,	.	.	.	*	.	.	.	.	.	.	373	LXI, figs. 1–9; LXIII, fig. 6?; XCIII, fig. 27.
348	17	G. subarcuata, Hall,	.	.	.	.	.	.	*	.	.	.	375	LXI, figs. 10–22; XCIII, fig. 26.
		d. elongata.												
349	18	G. præcursor, Hall,	*	.	.	.	.	.	.	.	.	.	376	LIX, fig. 1.
350	19	G. secunda, Hall,	.	*	.	.	.	.	.	.	.	.	376	LIX, figs. 2, 3.
351	20	G. constricta, Hall,	.	.	.	*	.	.	.	.	.	.	377	LIX, figs. 13–20, (4, 5?); LXXVIII, figs. 26, 27.
352	21	G. communis, n. sp.,	.	.	.	.	.	.	*	.	.	.	378	LXI, figs. 24–28; XCIII, fig. 20.
353	22	G. undata, Hall,	.	.	.	.	.	.	*	.	.	.	379	LXI, fig. 23; LXIV, fig. 30; XCIII, fig. 21.
354	23	G. duplicata, n. sp.,	.	.	.	.	.	.	*	.	.	.	380	XCIII, fig. 23.
355	24	G. Hannibalensis, Shumard,	.	.	.	.	.	.	.	.	*	.	381	LXI, figs. 29, 30, 33.
356	25	G. plena, n. sp.,	.	.	.	.	.	.	.	.	*	.	382	LXI, figs. 31, 32.
357	26	G. (Sphenomya) cuneata, Hall,	.	.	.	*	.	.	.	.	.	.	383	LXII, figs. 1–9; XCIII, fig. 19.
			1	2		15			8		2			
	30	**Enthydesma,** NOV. GEN.												
358	1	E. subtextile, Hall,	.	.	.	.	.	*	.	.	.	.	385	LXIII, figs. 11–16; XCIII, figs. 28, 29.
								1						
	31	**Edmondia,** De Koninck. 1844.												
359	1	E. rhomboidea, Hall,	.	.	.	.	.	.	*	.	.	.	386	LXIV, figs. 7, 8; LXXV, fig. 42; XCV, figs. 15, 16.
360	2	E. Philipi, Hall,	.	.	.	.	.	.	*	.	.	.	387	LXIV, figs. 9, 11–14, 17, 29; XCV, figs. 1–4.
361	3	E. tumidula, n. sp.,	.	.	.	.	.	.	*	.	.	.	388	LXIV, figs. 15, 23, (16?); XCV, figs. 5–8.
362	4	E. subovata, n. sp.,	.	.	.	.	.	.	*	.	.	.	389	LXIV, figs. 18, 19, 20, 26, 27, 28, (10, 21?); XCV, figs. 9–12.
363	5	E. transversa, n. sp.,	.	.	.	.	.	.	*	.	.	.	389	LXIV, fig. 24.
364	6	E. Burlingtonensis, White and Whitfield,	.	.	.	.	.	.	.	.	*	.	390	LXIV, fig. 22; XCV, figs. 13, 14.
365	7	E. depressa, Hall,	.	.	.	.	.	.	.	.	*	.	391	LXIV, fig. 32.
366	8	E. ellipsis, n. sp.,	.	.	.	.	.	.	.	.	*	.	392	LXIV, fig 25.
367	9	E ? tenuistriata, n. sp.,	.	.	.	.	.	.	*	.	.	.	393	LXIII, figs. 9, 10; XCV, fig. 17.
368	10	E. ? subcarinata, Hall,	.	.	.	.	.	.	*	.	.	.	. . .	Explanation of Pl. LXIV, fig. 31.
									7		3			
	32	**Sphenotus,** NOV. GEN.												
369	1	S. truncatus, Conrad,	.	.	.	*	.	.	.	.	.	.	394	LXV, figs. 1, 4–6.
370	2	S. arcæformis, Hall,	.	.	.	*	.	.	*	.	.	.	395	LXV, figs. 7–11; LXVI, fig. 43?
371	3	S. cuneatus, Conrad,	.	.	.	*	.	.	.	.	.	.	396	LXV, figs. 12–17.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous. ‡	Page.	Plates and Figs.
372	4	S. subtortuosus, Hall,	.	.	.	*	.	.	.	.	.	.	397	LXV, figs. 18, 19.
373	5	S. solenoides, Hall,	.	.	.	*	.	.	.	.	.	.	398	LXV, figs. 21–29.
374	6	S. contractus, Hall.	.	.	.	.	.	.	*	.	.	.	399	LXVI, figs. 1, 3–9, 11–13, 15, (t0, 16, 17, 19?) XCIV, fig. 2.
375	7	S.? arcuatus, n. sp.,	.	.	.	.	.	.	*	.	.	.	400	LXVI, fig. 18.
376	8	S. clavulus, Hall,	.	.	.	.	.	.	*	.	.	.	401	LXVI, figs. 2, 20–26.
377	9	S. rigidus, White and Whitfield,	.	.	.	.	.	.	.	.	*	.	402	LXVI, fig. 14.
378	10	S. flavius, Hall,	.	.	.	.	.	.	.	.	*	.	403	LXVI, figs. 27–29.
379	11	S. valvulus, Hall,	.	.	.	.	.	.	.	.	*	.	403	LXVI, fig. 30.
380	12	S. Æolus, Hall.	.	.	.	.	.	.	.	.	*	.	404	LXVI, figs. 31–35.
381	13	S. signatus, n. sp.,	.	.	.	.	.	.	.	.	*	.	405	XCIV, fig. 3.
382	14	S. Telamon, n. sp.,	.	.	.	.	.	.	.	.	*	.	406	XCIV, fig. 1.
	33	**Spathella,** NOV. GEN.				5			4		6			
383	1	S. typica, n. sp.,	.	.	.	.	.	.	*	.	.	.	407	LXVI, figs. 36–40.
384	2	S. ventricosa, White and Whitfield,	.	.	.	.	.	.	.	.	*	.	408	LXVI, figs. 41, 42.
	34	**Conocardium,** Bronn. 1835.							1		1			
385	1	C. cuneus, Conrad,	*	*	.	.	.	.	.	.	.	.	409	LXVII, figs. 1–32; LXVIII, figs. 1, 4–16; XCIV, figs. 11, 12.
386	2	C. cuneus, var. attenuatum, Conrad,	*	.	.	.	.	.	.	.	.	.	410	LXVII, figs. 1–11.
387	3	C. cuneus, var. trigonale, Hall,	.	*	.	.	.	.	.	.	.	.	410	LXVII, fig. 28; LXVIII, figs. 1, 4–16; XCIV, fig. 11.
388	4	C. cuneus, var. nasutum, Hall,	*	.	.	.	.	.	.	.	.	.	410	LXVII, figs. 12–20.
389	5	C. Ohioense, Meek,	.	*	.	.	.	.	.	.	.	.	411	LXVIII, figs. 2, 3.
390	6	C. normale, Hall,	.	.	.	*	.	.	.	.	.	.	411	LXVIII, figs. 17–19.
391	7	C. Eboraceum, Hall,	.	.	.	*	.	.	.	.	.	.	412	LXVIII, figs. 20–23.
392	8	C. denticulatum, Hall,	.	.	.	*	.	.	.	.	.	.	413	LXVIII, figs. 24, 25.
393	9	C. concinnum, Hall,	.	.	.	*	.	.	.	.	.	.	414	LXVIII, figs. 26, 27.
394	10	C. liratum, Hall,	.	.	.	.	.	.	*	.	.	.	414	LXVIII, figs. 28, 29.
395	11	C. reliquum, Hall,	.	.	.	.	.	.	*?	.	.	.	415	LXVIII, fig. 33.
396	12	C. tegulum, Hall, . . Niagara,	.	.	.	.	.	.	.	.	.	.	415	LXVIII, figs. 30, 31.
397	13	C. inceptum, Hall, Lower Helderberg,	.	.	.	.	.	.	.	.	.	.	415	LXVIII, fig. 32.
	35	**Panenka,** Barrande. 1881.	3	3		4			2					
398	1	P. dichotoma, Hall,	*	.	.	.	.	.	.	.	.	.	416	LXX, fig. 21; XCIV, fig. 13.
399	2	P. alternata, n. sp.,	.	*	.	.	.	.	.	.	.	.	416	Not figured.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.	Catskill.	Waverly.	Carboniferous.	Page.	Plates and Figs.
400	3	P. multiradiata, n. sp.,	.	*	.	.	.	.	.	.	.	.	417	LXIX, fig. 5; XCIV, fig. 18.
401	4	P. ventricosa, n. sp.,	.	.	*	.	.	.	.	.	.	.	417	LXIX, figs. 1, 2.
402	5	P. Hero, Hall,	.	.	*	.	.	.	.	.	.	.	418	LXIX, fig. 3.
403	6	P. æquilatera, Hall,	.	.	*	*	.	.	.	.	.	.	419	LXIX, figs. 4, (7?); XCIV, fig. 17.
404	7	P. costata, n. sp.,	.	.	*	.	.	.	.	.	.	.	419	XCIV, fig. 15.
405	8	P. Lincklæni, Hall,	.	.	*	.	.	.	.	.	.	.	420	LXIX, figs. 12–14.
406	9	P. mollis, n. sp.,	.	.	*	.	.	.	.	.	.	.	420	LXXX, figs. 8, (9?).
407	10	P. retusa, Conrad,	.	.	.	*	.	.	.	.	.	.	421	LXIX, fig. 6.
408	11	P. potens, n. sp.,	.	.	.	*	.	.	.	.	.	.	422	LXIX, figs. 8, 10.
409	12	P. radians, Conrad,	.	.	.	*	.	.	.	.	.	.	422	LXIX, fig. 9.
410	13	P. abrupta, n. sp.,	.	.	.	*	.	.	.	.	.	.	423	LXIX, fig. 11; XCIV, fig. 16.
411	14	P. degener, n. sp.,	.	.	.	*	.	.	.	.	.	.	424	XCIV, fig. 14.
412	15	P. robusta, Hall,	.	.	.	.	.	*	.	.	.	.	424	LXX, figs. 22–24.
413	16	P. Poulsoni, Conrad,	.	.	.	.	.	.	*?	.	.	.	425	Not figured.
414	17	P. elevata, Conrad,	.	.	.	.	.	.	*?	.	.	.	425	Not figured.
			1	2	6	6		1	2					
	36	**Glyptocardia,** NOV. GEN.												
415	1	G. speciosa, Hall,	.	.	.	*	*	*	.	.	.	.	426	LXX, figs. 2–9; LXXX, fig. 10.
						1	1	1						
	37	**Præcardium,** Barrande. 1881.												
416	1	P. vetustum, Hall,	.	.	.	.	.	*	.	.	.	.	427	LXX, figs. 18–20.
								1						
	38	**Paracardium,** Barrande. 1881.												
417	1	P. Doris, Hall,	.	.	.	.	.	*	.	.	.	.	428	LXX, figs. 10, 11.
								1						
	39	**Pararca,** NOV. GEN.												
418	1	P. præcedens, n. sp.,	.	*	.	.	.	.	.	.	.	.	429	XCIV, fig. 19.
419	2	P. transversa, Hall,	.	.	.	.	.	.	*	.	.	.	429	LXX, figs. 12, 14, 15.
420	3	P. Sao, Hall,	.	.	.	.	.	.	*	.	.	.	430	LXX, fig. 17.
421	4	P. venusta, n. sp.,	.	.	.	.	.	.	*	.	.	.	431	XCIV, fig. 22.
422	5	P. neglecta, n. sp.,	.	.	.	.	.	.	.	.	*	.	432	LXX, fig. 13.
423	6	P. erecta, Hall,	.	.	.	.	.	.	.	.	*	.	432	LXX, fig. 16; XCIV, figs. 20, 21.
				1					3		2			

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
	40	**Cardiopsis,** Meek and Worthen. 1861.												
424	1	C. radiata, Meek and Worthen, .	.	.	.	.	.	.	.	.	*	.	433	LXX, fig. 25.
											1			
	41	**Lunulicardium,** Munster. 1840.												
425	1	L. fragile, Hall, ...	.	.	*	*	*	*	*	.	.	.	434	LXXI, figs. 1–14.
426	2	L. Marcellense, Vanuxem, . .	.	.	*	.	.	.	.	.	.	.	435	LXXI, figs. 15, 16.
427	3	L. rude, Hall, ...	.	.	*	.	.	.	.	.	.	.	435	LXXI, fig. 17.
428	4	L. orbiculare, n. sp., ...	.	.	*	.	.	.	.	.	.	.	436	LXXI, fig 24.
429	5	L. curtum, Hall, ...	.	.	*	*	.	.	.	.	.	.	437	LXXI, figs. 18–23.
430	6	L. ornatum, Hall, ...	.	.	.	.	.	*	*	.	.	.	437	LXXI, figs. 25–32.
431	7	L. transversum, n. sp., . . .	.	.	.	.	.	.	*	.	.	.	439	XCIV, figs. 24, 25.
					5	2	1	2	3					
	42	**Paracyclas,** Hall. 1843.												
432	1	P. elliptica, Hall, ...	.	*	.	*	.	.	.	.	.	.	440	LXXII, figs. 23–33; XCV, fig. 18.
433	2	P. lirata, Conrad, ...	.	.	.	*	.	.	.	.	.	.	441	LXXII, figs. 2–19; XCV, fig. 19.
434	3	P. Ohioensis, Meek, ...	.	.	.	*	.	.	.	.	.	.	442	LXXII, fig. 1; XCV, fig. 24.
435	4	P. tenuis, Hall, ...	.	.	.	*	.	.	.	.	.	.	443	LXXII, figs. 20–22; XCV, fig. 25.
436	5	P. Chemungensis, n. sp., . . .	.	.	.	.	.	.	*	.	.	.	443	XCV, fig. 23.
437	6	P. ignota, Hall, ...	.	.	.	.	.	.	*	.	.	.	444	LXXII, fig. 34.
438	7	P. rotunda, Hall, ...	.	.	.	.	.	.	*	.	.	.	444	LXIII, figs. 18, 19; XCV, fig. 21.
439	8	P. erecta, n. sp., ...	.	.	.	.	.	.	*	.	.	.	445	XCV, fig. 22.
440	9	P.? pauper, Hall, ...	.	.	.	.	.	.	*	.	.	.	446	LXXV, figs. 24–26; XCV, fig. 20.
				1		4			5					
	43	**Schizodus,** King. 1844.												
441	1	S.? fissa, Hall, ...	*	.	.	.	.	.	.	.	.	.	447	LXXII, figs. 35–41.
442	2	S. tumidus, Hall, ...	.	*	.	.	.	.	.	.	.	.	448	LXXV, figs. 1, 2.
443	3	S. appressus, Conrad, ...	.	.	.	*	.	.	.	.	.	.	449	LXXV, figs. 3–9.
444	4	S. ellipticus, Hall, ...	.	.	.	*	.	.	.	.	.	.	450	LXXV, figs. 13–15.
445	5	S. contractus, n. sp, ...	.	.	.	*	.	.	.	.	.	.	451	LXXV, figs. 27, 28.
446	6	S. gregarius, Hall, ...	.	.	.	.	.	.	*	.	.	.	452	LXXV, figs. 16–18; XCV, fig. 27.
447	7	S. rhombeus, Hall, ...	.	.	.	.	.	.	*	.	.	.	452	LXXV, figs. 19–23.
448	8	S. Chemungensis, Conrad, . . .	.	.	.	.	.	.	*	.	.	.	453	LXXV, figs. 37–40, 45, 41?
449	9	S. Chemungensis, var. quadrangularis, Hall, ...	.	.	.	.	.	.	*	.	.	.	454	LXXV, figs. 31–34, 36.
450	10	S. oblatus, Hall, ...	.	.	.	.	.	.	*	.	.	.	455	LXXV, figs. 43, 44.
451	11	S. degener, n. sp., ...	.	.	.	.	.	.	*	.	.	.	456	LXIII, fig. 17.
452	12	S. patulus, n. sp., ...	.	.	.	.	.	.	*	.	.	.	457	LXIII, fig. 20.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
453	13	S. eminens, n. sp.,	.	.	.	.	.	.	*	.	.	.	457	XCV, fig. 28.
454	14	S. cuneus, Hall,	.	.	.	.	.	.	.	.	*	.	458	LXXV, figs. 29, 30?
455	15	S. æqualis, n. sp.,	.	.	.	.	.	.	.		*	.	458	LXXV, fig. 35; XCV, fig. 29.
	44	**Prothyris,** Meek. 1869.	1	1		3			8		2			
456	1	P. planulata, Hall,	.	.	.	*	.	.	.	.	.	.	460	LXXVI, fig. 1; XCIV, fig. 8.
457	2	P. lanceolata, Hall,	.	.	.	*	.	.	.	.	.	.	460	LXXVI, figs. 2–8.
458	3	P. alata, n. sp.,	.	.	.	.	.	.	*	.	.	.	461	XCIV, fig. 7.
459	4	P. exuta, n. sp.,	.	.	.	.	.	.	*	.	.	.	462	XCIV, fig. 9.
	45	**Solemya,** Lamarck. 1818. *JANEIA*, King. 1850.				2			2					
460	1	S. (J.) vetusta, Meek,	.	.	.	*	.	.	.	.	.	.	463	XLVII, figs. 53–55; XCIV, fig. 10.
	46	**Tellinopsis,** Hall. 1870.				1								
461	1	T. submarginata, Conrad,	.	.	.	*	.	.	.	.	.	.	464	LXXVI, figs. 21–31.
	47	**Cimitaria,** Hall. 1870.				1								
462	1	C. corrugata, Conrad,	.	.	.	*	.	.	.	.	.	.	465	LXXVII, figs. 1–4.
463	2	C. elongata, Conrad,	.	.	.	*	.	.	.	.	.	.	466	LXXVII, figs. 5–8.
464	3	C. recurva, Conrad,	.	.	.	*	.	.	.	.	.	.	467	LXXVII, figs. 9–14, 16.
465	4	C. angulata, n. sp.,	.	.	.	.	.	.	*	.	.	.	468	LXXVII, fig. 15.
	48	**Pholadella,** Hall. 1870.				3			1					
466	1	P. radiata, Conrad,	.	.	.	*	.	.	*	.	.	.	469	LXXVIII, figs. 15–21; XCVI, fig. 1.
467	2	P. parallela, Hall,	.	.	.	*	.	.	.	.	.	.	470	LXXVIII, figs 22–24.
468	3	P. Newberryi, Hall,	.	.	.	.	.	.	.	.	*	.	471	LXXVIII, fig. 25.
	49	**Phthonia,** Hall. 1870.				2			1		1			
469	1	P. cylindrica, Hall,	.	.	.	*	.	.	.	.	.	.	473	LXXVIII, figs. 1–4.
470	2	P. nodicostata, Hall,	.	.	.	*	.	.	.	.	.	.	474	LXXVIII, figs. 5–9.
471	3	P. sectifrons, Conrad,	.	.	.	*	.	.	.	.	.	.	475	LXXVIII, figs. 10–13.
472	4	P. lirata, Hall,	.	.	.	*	.	.	.	.	.	.	476	LXXVIII, fig. 14.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
473	5	P. truncata, n. sp.,	.	.	.	.	.	.	*	.	.	.	476	XCIV, fig. 4.
474	6	P. nitida, n. sp.,	.	.	.	.	.	.	*	.	.	.	477	XCIV, figs. 5, 6.
	50	**Orthonota,** Conrad. 1841.				4			2					
475	1	O. undulata, Conrad,	.	.	.	*	.	.	.	.	.	.	478	LXXVIII, figs. 37–42.
476	2	O. carinata, Conrad,	.	.	.	*	.	.	.	.	.	.	479	LXXVIII, figs. 34, 35.
477	3	O. ensiformis, Hall,	.	.	.	*	.	.	.	.	.	.	480	LXXVIII, fig. 36.
478	4	O. rigida, n. sp.,	.	.	.	.	.	.	*	.	.	.	481	LXXX, fig. 6.
479	5	O.? parvula, Hall,	.	.	.	*	.	.	.	.	.	.	482	LXV, figs. 2, 3; LXXVIII, figs. 29–32.
	51	**Solen,** *s. g. PALÆOSOLEN,* N. S. G.				1			1					
480	1	S. (P.) siliquoidea, Hall,	.	.	.	*	.	.	.	.	.	.	483	LXXVIII, fig. 33.
	52	**Cypricardinia,** Hall. 1859.				1								
481	1	C. planulata, Conrad,	*	.	.	.	.	.	.	.	.	.	484	LXXIX, figs. 1–5.
482	2	C. indenta, Conrad,	.	*	.	*	.	.	.	.	.	.	485	LXXIX, figs. 6–16, 23; XCVI, fig. 2.
483	3	C. arcuata, n. sp.,	.	.	.	.	.	.	*	.	.	.	486	LXXIX, fig. 17.
484	4	C.? cylindrica, Hall and Whitfield,	.	.	.	*	.	.	.	.	.	.	486	LXXIX, figs. 24, 25.
485	5	C. consimilis, n. sp.,	.	.	.	.	.	.	.	.	*	.	486	LXXIX, figs. 19, 20, 21, (18?); XCVI, fig. 3.
486	6	C. sulciferus, Winchell,	.	.	.	.	.	.	.	.	*	.	487	LXXIX, fig. 22.
	53	**Palæanatina,** Hall. 1870.	1	1		2			1		2			
487	1	P. typa, Hall,	.	.	.	.	.	.	*	.	.	.	488	LXXIX, figs. 26–28, 35–37.
488	2	P. solenoides, n. sp.,	.	.	.	.	.	.	*	.	.	.	489	LXXIX, figs. 38, 39.
489	3	P. angusta, n. sp.,	.	.	.	.	.	.	*	.	.	.	490	LXXIX, figs. 29–34.
490	4	P. sinuata, n. sp.,	.	.	.	.	.	.	*	.	.	.	491	XCVI, fig. 4.
	54	**Prorhynchus,** NOV. GEN.							4					
491	1	P. quadratum, Hall,	.	.	.	.	.	.	*	.	.	.	492	LXXIX, figs. 40–49; XCVI, fig. 5.
492	2	P. nasutum, n. sp.,	.	.	.	.	.	.	*	.	.	.	493	XCVI, fig. 6.
493	3	P. angulatum, n. sp.,	.	.	.	.	.	.	*	.	.	.	493	XCVI, fig. 7.
	55	**Glossites,** NOV. GEN.							3					
494	1	G. teretis, n. sp.,	.	*	.	.	.	.	.	.	.	.	494	XCVI, fig. 18.

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.	Catskill.	Waverly.	Carboniferous.	Page.	Plates and Figs.
495	2	G. subtenuis, n. sp.,	.	.	.	*	.	.	.	.	.	.	495	XL, figs. 12, 20.
496	3	G. depressus, n. sp.,	.	.	.	.	.	.	*	.	.	.	496	XL, figs. 15, 17; XCVI, fig. 12.
497	4	G. lingualis, n. sp.,	.	.	.	.	.	.	*	.	.	.	497	XL, figs 16, 19; XCVI, figs. 9–11.
498	5	G. ellipticus, n. sp.,	.	.	.	.	.	.	*	.	.	.	498	XCVI, fig. 8.
499	6	G. rudicula, n. sp.,	.	.	.	.	.	.	*	.	.	.	498	XCVI, fig. 17.
500	7	G. procerus, n. sp.,	.	.	.	.	.	.	*	.	.	.	499	XCVI, fig. 13.
501	8	G. subnasutus, n. sp.,	.	.	.	.	.	.	*	.	.	.	500	XCVI, fig. 14.
502	9	G patulus, n. sp.,	.	.	.	.	.	.	*	.	.	.	501	XCVI, figs. 15, 16.
503	10	G. amygdalinus, Winchell,	.	.	.	.	.	.	.	.	*	.	501	XL, figs. 13, 14.
				1		1			7		1			
	56	**Elymella,** NOV. GEN.												
504	1	E. fabalis, n. sp.,	.	.	.	*	.	.	.	.	.	.	502	XL, figs. 5, 9.
505	2	E. nuculoides, n. sp.,	.	.	.	*	.	.	.	.	.	.	503	XL, figs. 6, 7, 8, 10?
506	3	E. levata, n. sp.,	.	.	.	*	.	.	.	.	.	.	504	Not figured.
507	4	E. patula, n. sp.,	.	.	.	.	.	.	.	.	*	.	505	XL, fig. 11.
						3					1			
508	1	Sphenotus (?) undatus, Hall,	.	.	.	.	.	.	*	.	.	.	506	LXXX, fig. 6.
509	1	Grammysia (?) subnasuta, Hall,	.	.	.	.	.	.	*	.	.	.	507	LXIV, figs. 5, 6.
	57	**Sanguinolites,** McCoy. 1844.												
510	1	S.? undulatus, Hall,	.	.	.	.	.	.	*	.	.	.	508	LXIV, figs. 1, 2.
511	2	S.? subtruncatus, n. sp.,	.	.	.	.	.	.	*	.	.	.	508	LXIV, figs. 3, 4.
									2					
	58	**Protomya,** NOV. GEN.												
512	1	P. oblonga, Hall,	.	.	.	*	.	.	.	.	.	.	509	LXIII, fig. 21.
						1								
	59	**Promacrus,** Meek. 1871.												
513	1	P. cuneatus, Hall,	.	.	.	.	.	.	.	.	*	.	510	LXXVIII, fig. 28.
											1			
	60	**Cytherodon,** Hall. 1873.												
514	1	C. nasutus, Hall,	.	.	.	*	.	.	.	.	.	.	511	LXXV, figs. 10–12; XCV, fig. 30.
						1								

SYNOPTICAL TABLE—Continued.

Serial No.	Species No.	NAME AND AUTHOR.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee slate.	Portage.	Chemung.*	Catskill.	Waverly.†	Carboniferous.	Page.	Plates and Figs.
	61	**Clinopistha,** Meek and Worthen, 1870.												
515	1	C. subnasuta, Hall and Whitfield, .	.	.	.	*	.	.	.	.	.	.	512	LI, figs. 32, 33; XCV, fig. 31.
516	2	C. telliniformis, Hall, ...	.	*	.	.		.	.	.	.	.	513	LI, figs. 28–31.
				1		1								
	62	**Modiella,** Hall. 1883.												
517	1	M. pygmæa, Conrad, ...	.	.	.	*	.	.	.	.	.	.	514	LXXVI, figs. 9–20.
						1								
	63	**Megambonia,** Hall. 1859.												
518	1	M. cardiiformis, Hall, ...	.	*	.	.	.	.	.	.	.	.	515	LII, figs. 1–8.
				1										
	64	**Amnigenia,** Hall. 1883.												
519	1	A. Catskillensis, Vanuxem, . .	.	.	.	*?	.	*	.	*	.	.	516	XL, figs. 1–4; LXXX, fig. 12.
		See p. 518. Oneonta sandstone—Portage group ?				1		1		1				
	65	**Allocardium,** Hall. 1884.												
520	1	A. alternatum, Hall, ...	.	.	.	*	.	.	.	.	.	.	—	Explanation of fig. 15, plate XXIV.
						1								

* The Chemung group is here intended to include all the strata between the Catskill and Portage groups. In this volume the strata at Ithaca have been referred to the lower portion of the Chemung group.

† The term Waverly group is here used to include the members of the Lower Carboniferous, equivalent to the Burlington sandstones, the Marshall group, the Waverly group and the Kinderhook group.

SUMMARY.

	No. of Species.	NAME.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee.	Portage.	Chemung.	Catskill.	Waverly.	Carboniferous.
I	34	Aviculopecten,	.	5	1	12	.	.	16	.	1	.
II	13	Lyriopecten,	1	1	.	4	.	.	7	.	.	.
III	22	Pterinopecten,	.	5	3	8	.	.	7	.	.	.
IV	9	Crenipecten,	.	.	.	.	.	.	8	.	1	.
V	12	Pterinea,	.	3	.	1	.	.	10	.	.	.
VI	18	Actinopteria,	1	.	2	5	.	.	10	.	.	.
VII	22	Ptychopteria,	.	.	.	.	.	.	22	.	.	.
VIII	3	Glyptodesma,	.	1	.	2	.	.	.	.	.	.
IX	15	Leiopteria,	.	1	1	11	.	.	3	.	.	.
X	57	Leptodesma,	.	.	1	1	.	.	55	.	.	.
XI	3	Pteronites,	.	.	.	.	.	.	3	.	.	.
XII	2	Palæopinna,	.	1	.	.	.	.	.	.	.	.
XIII	1	Ectenodesma,	.	.	.	.	.	.	1	.	.	.
XIV	5	Limoptera,	.	1	.	4	.	.	.	.	.	.
XV	1	Byssopteria,	.	.	.	.	.	.	1	.	.	.
XVI	15	Mytilarca,	2	1	.	2	.	.	8	.	2	.
XVII	2	Gosselettia,	.	.	.	2	.	.	.	.	.	.
XVIII	2	Modiola,	.	.	.	.	.	.	2	.	.	.
XIX	24	Modiomorpha,	3	5	1	9	.	.	7	.	1	.
XX	13	Goniophora,	2	.	.	7	.	.	4	.	.	.
XXI	6	Microdon,	.	1	.	4	.	.	2	.	1	.
XXII	13	Nucula,	.	.	.	9	.	.	5	.	1	.
XXIII	4	Nuculites,	.	.	1	4	.	.	.	.	.	.
XXIV	5	Leda,	.	.	.	4	.	.	.	.	1	.
XXV	20	Palæoneilo,	.	1	.	10	.	1	9	.	3	.
XXVI	3	Macrodon,	.	.	.	1	.	.	1	.	1	.
XXVII	3	Ptychodesma,	.	.	.	1	.	.	2	.	.	.
XXVIII	4	Nyassa,	.	1	.	3	.	.	.	.	.	.
XXIX	27	Grammysia,	1	2	.	15	.	.	9	.	2	.
XXX	1	Euthydesma,	.	.	.	.	.	1	.	.	.	.
XXXI	10	Edmondia,	.	.	.	.	.	.	7	.	3	.
XXXII	15	Sphenotus,	.	.	.	5	.	.	5	.	6	.
XXXIII	2	Spathella,	.	.	.	.	.	.	1	.	1	.
XXXIV	13	Conocardium,	3	3	.	4	.	.	2	.	.	.
XXXV	17	Panenka,	1	2	6	6	.	1	2	.	.	.
XXXVI	1	Glyptocardia,	.	.	.	1	1	1	.	.	.	.
XXXVII	1	Præcardium,	.	.	.	.	.	1	.	.	.	.
XXXVIII	1	Paracardium,	.	.	.	.	.	1	.	.	.	.
XXXIX	6	Pararca,	.	1	.	.	.	.	3	.	2	.
XL	1	Cardiopsis,	.	.	.	.	.	.	.	.	1	.
XLI	7	Lunulicardium,	.	.	5	2	1	2	3	.	.	.
XLII	9	Paracyclas,	.	1	.	4	.	.	5	.	.	.
XLIII	15	Schizodus,	1	1	.	3	.	.	8	.	2	.
XLIV	4	Prothyris,	.	.	.	2	.	.	2	.	.	.
XLV	1	Solemya,	.	.	.	1	.	.	.	.	.	.
XLVI	1	Tellinopsis,	.	.	.	1	.	.	.	.	.	.
XLVII	4	Cimitaria,	.	.	.	3	.	.	1	.	.	.
XLVIII	3	Pholadella,	.	.	.	2	.	.	1	.	1	.
XLIX	6	Phthonia,	.	.	.	4	.	.	2	.	.	.
L	5	Orthonota,	.	.	.	4	.	.	1	.	.	.
LI	1	Palæosolen,	.	.	.	1	.	.	.	.	.	.
LII	6	Cypricardinia,	1	1	.	2	.	.	1	.	2	.

SUMMARY—Continued.

	No. of Species.	NAME.	Schoharie grit.	Corniferous.	Marcellus.	Hamilton.	Genesee.	Portage.	Chemung.	Catskill.	Waverly.	Carboniferous.
LIII	4	Palæanatina,	.	.	.	.	.	.	4	.	.	.
LIV	3	Prorhynchus,	.	.	.	.	.	.	3	.	.	.
LV	10	Glossites,	.	1	.	1	.	.	7	.	1	.
LVI	4	Elymella,	.	.	.	3	.	.	.	.	1	.
LVII	2	Sanguinolites,	.	.	.	.	.	.	2	.	.	.
LVIII	1	Palæomya,	.	.	.	1	.	.	.	.	.	.
LIX	1	Promacrus,	.	.	.	.	.	.	.	.	1	.
LX	1	Cytherodon,	.	.	.	1	.	.	.	.	.	.
LXI	2	Dystactella,	.	1	.	1	.	.	.	.	.	.
LXII	1	Modiella,	.	.	.	1	.	.	.	.	.	.
LXIII	1	Megambonia,	.	1	.	.	.	.	.	.	.	.
LXIV	1	Amnigenia.	.	.	.	1?	.	1?	.	1	.	.
LXV	1	Allocardium,	.	.	.	1	.	.	.	.	.	.
65	520		16	41	21	174	2	9	252	1	35	

ALPHABETICAL ARRANGEMENT OF THE GENERA AND SPECIES.

NAME.	PAGE.	PLATE AND FIGURE.
Actinopteria, Hall. 1883.		
A. auriculata, Hall,	121	LXXXIV, fig. 15.
A. decussata, Hall,	111	XVII, figs. 24, 28; XVIII, figs. 1–15; XX, fig. 19; LXXXIV, fig. 4.
A. Boydi, Conrad,	113	XIX, figs. 2–24, 26–30; LXXXIV, figs. 16, 17.
A. delta, Hall,	121	XXIII, fig. 3.
A. Doris, Hall,	109	XVII, fig. 4.
A. epsilon, Hall,	122	XXIII, figs. 4 (5, 6 ?), 8.
A. eta, Hall,	124	LXXXIV, figs. 8–11.
A. eximia, Hall,	107	XXV, fig. 1.
A. iota, Hall,	127	LXXXIV, fig. 7.
A. kappa, Hall.	128	LXXXIV, fig. 13.
A. muricata, Hall,	108	XVII, figs. 1–3.
A. perobliqua, Conrad,	116	XIX, fig. 31; LXXXIV, fig. 14.
A. perstrialis, Hall,	118	XXIII, figs. 2, 7; LXXXIV, fig. 12.
A. pusilla, Hall,	117	LXXXIV, fig 3.
A. subdecussata, Hall,	110	XVII, figs. 23, 25–27, 29–31; XIX, fig. 25.
A. tennistriata, Hall,	120	LXXXIV, figs. 5, 6.
A. theta, Hall,	125	LXXXIV, figs. 18, 19.
A. zeta, Hall,	123	XXIII, fig. 9; LXXXIV, figs. 1, 2.
Allocardium, Hall. 1884.		
A. alternatum, Hall,	—	Explanation of fig. 15, plate XXIV.
Amnigenia, Hall. 1883.		
A. Catskillensis, Vanuxem,	516	XL, figs. 1–4; LXXX, fig. 12.
Aviculopecten, McCoy. 1851.		
A. æquilateralis, Hall,	19	LXXXII, fig. 1.
A. bellus, Conrad,	35	II, figs. 5, 6, 9; LXXXI, fig. 8
A. cancellatus, Hall,	18	VII, figs. 12, 14–19.
A. Caroli, Winchell,	29	IX, fig. 5.
A. celsus, Hall,	23	VII, figs. 29, 30.
A. Cleon, Hall,	6	I, fig. 1.
A. convexus, Hall,	28	VII, figs. 22, 23.
A. dolabriformis, Hall,	26	VII, fig. 21.
A. duplicatus, Hall,	17	VII, figs. 1–7; LXXXI, figs. 9, 10.
A. ellipticus, Hall,	25	VII, fig. 31.
A. exacutus, Hall,	8	III, figs. 18–22.
A. fasciculatus, Hall,	11	V, figs. 9–17; LXXXI, figs. 1–4.
A. formio, Hall,	9	V, figs. 20, 21.
A. Idas, Hall,	13	III, figs. 1, 2; XXIV, fig. 4.
A. ignotus, Hall,	33	I, fig. 2.
A. insignis, Hall,	34	I, fig. 8; III, fig. 13; LXXXI, fig. 7.
A. Itys, Hall,	20	VII, fig. 13.
A. lautus, Hall,	14	III, figs. 16, 17; LXXXI, fig. 5.
A. mucronatus, Hall,	38	III, fig. 15.
A. ornatus, Hall.	37	II, figs. 7, 8; III, fig. 14.
A. patulus, Hall,	24	VII, figs. 32, 33.

ALPHABETICAL ARRANGEMENT—Continued.

NAME.	PAGE.	PLATE AND FIGURE.
Aviculopecten pecteniformis, Conrad,	4	I, fig. 9.
A. Phorcus, Hall,	10	V, fig. 22.
A. plenus, Hall,	21	XXIV, fig. 3.
A. princeps, Conrad,	1	I, figs. 10, 11; V, figs. 18, 19, 23, 24; VI, figs. 1-9; XXIV, fig. 7; LXXXI, figs. 13-17.
A. rugæstriatus, Hall,	15	VII, figs. 8-11; LXXXI, figs. 11, 12.
A. scabridus, Hall,	7	III, figs. 3-12.
A. signatus, Hall,	29	VII, fig. 24.
A. squama, Hall,	27	VII, fig. 20.
A. striatus, Hall,	22	X, figs. 3, 4.
A. tenuis, Hall,	39	VII, figs. 27, 28; LXXXI, fig. 6.
A. (Crenipecten?) incultus, Hall,	30	IX, fig. 3.
A. (Pterinopecten?) invalidus, Hall,	31	I, fig. 18; LXXXII, fig. 21.
A. (Pterinopecten?) terminalis, Hall,	32	I, fig. 3.
Byssopteria, Hall. 1883.		
B. radiata, Hall,	252	XXXII, figs. 21, 22; LXXX, fig. 11.
Cardiopsis, Meek and Worthen. 1861.		
C. radiata, Meek and Worthen,	433	LXX, fig. 25.
Cimitaria, Hall. 1870.		
C. angulata, n. sp.,	468	LXXVII, fig. 15.
C. corrugata, Conrad,	465	LXXVII, figs. 1-4.
C. elongata, Conrad,	466	LXXVII, figs. 5-8.
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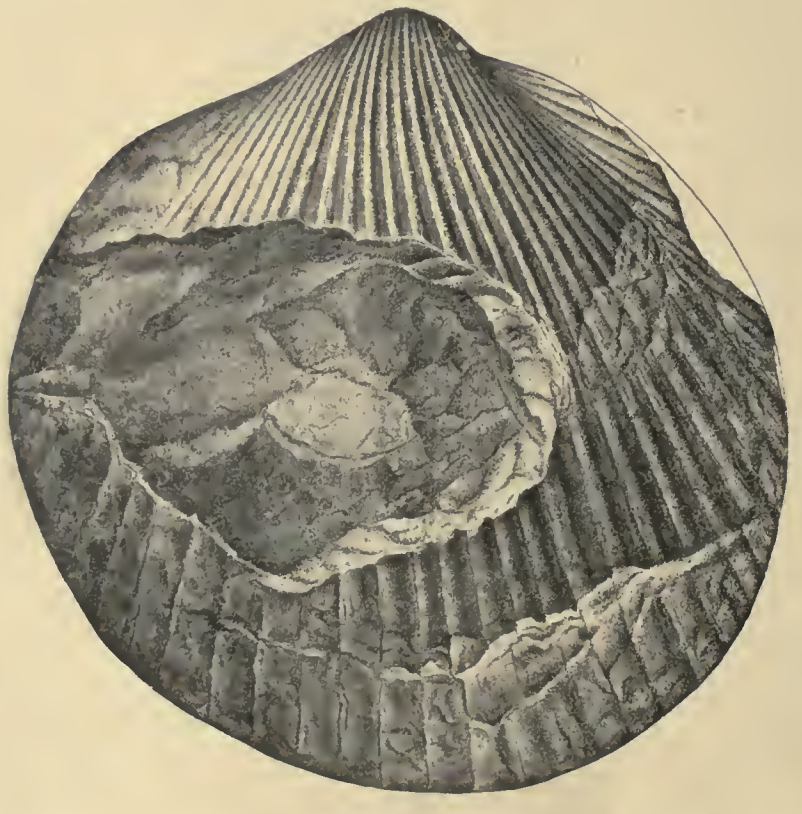
ELYMELLA LEVATA. A specimen retaining both valves in conjunction. See page 504. Hamilton Group. Schoharie County, N. Y.



PANENKA ALTERNATA. View of a large right valve showing the form of the shell and the general character of the surface ornamentation. The central portion of the valve has been broken away, and the radii are obscure on the marginal portions. The specimen is preserved in the dolomitic limestone of the Upper Helderberg group, from near Columbus, Ohio. See page 416.

PLATES AND EXPLANATIONS.

PLATE XXXIV.

GONIOPHORA PERANGULATA.

Page 293.

See Plate 42.

Figs. 1, 2. Two left valves, showing the general characters of the species.
Fig. 3. A small right valve.
Figs. 4–6. Right, anterior and cardinal views of a specimen preserving both valves.
Schoharie grit. *Schoharie, N. Y.*

GONIOPHORA ? ALATA.

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See Plate 42.

Fig. 7. An imperfect right valve.
Schoharie grit. *Schoharie, N. Y.*

NYASSA ELLIPTICA.

Page 357.

Fig. 8. A right valve with the shell almost entirely removed, showing the muscular scars and hinge-line as preserved on the cast of the interior.
Corniferous limestone. *Stafford, N. Y.*

MODIOMORPHA CONCENTRICA.

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See Plates 35, 36.

Fig. 9. The right side of a small specimen.
Fig. 10. A large specimen showing the anterior muscular scar and pallial line.
Hamilton group. *Near Louisville, Ky.*

PLATES AND EXPLANATIONS.

MODIOMORPHA ? PONDEROSA.

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See Plate 35.

Fig. 11. A cardinal view of the specimen, with the right valve partially worn away.
Fig. 12. The left side of the same specimen. See plate 35, fig. 8, for another figure of the same.
Corniferous limestone. *Clarence Hollow, N. Y.*

MODIOMORPHA SCHOHARIE.

Page 269.

See Plate 35.

Fig 13. The right side of a cast showing muscular scars and pallial line.
Schoharie grit. *Schoharie, N. Y.*

MODIOMORPHA COMPLANATA.

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See Plate 41.

Fig. 14. A cast of a left valve showing muscular impressions and pallial line.
Corniferous limestone. *Near Delaware, Ohio.*

MODIOMORPHA LINGUIFORMIS.

Page 274.

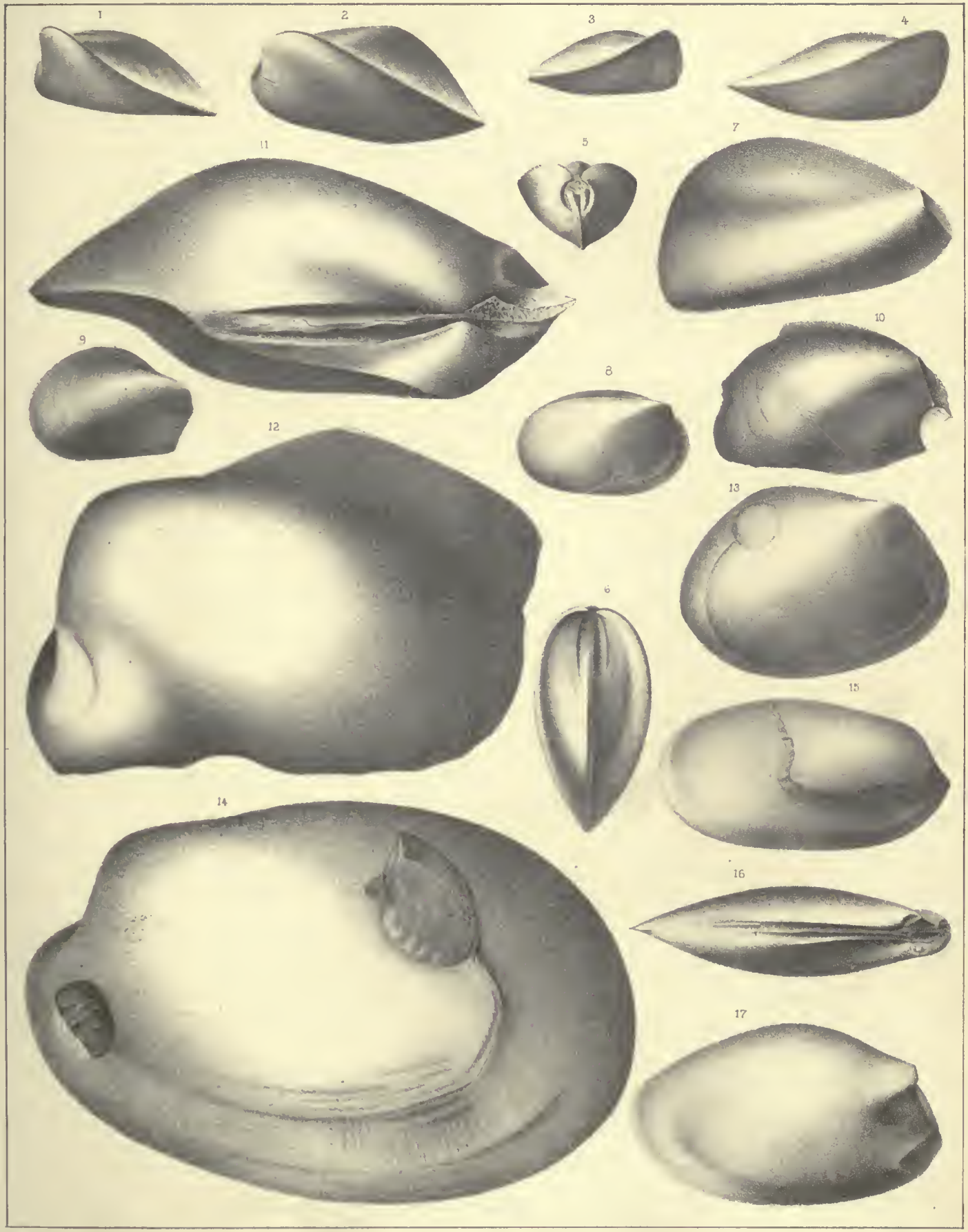
Fig. 15. The right side of the cast preserving a portion of the thickened shell, referred with some doubt to this species.
Fig. 16. A cardinal view of a cast of the interior of another specimen.
Fig. 17. The right side of the preceding.
Corniferous limestone. *Columbus, O.*

UPPER HELDERBERG GROUP.

(MODIOMORPHIDÆ.)

Palæontology N.Y. Vol V

Plate XXXIV.



G.B. Simpson del

Swinton, lith.

PLATE XXXV.

MODIOMORPHA CONCENTRICA.

Page 275.

See Plates 34, 36.

Fig. 1. A right valve of a young individual showing a strongly angular umbonal ridge, a furrow along the middle of the cardinal slope, and the anterior muscular impression.
Hamilton group. *Delphi, N. Y.*

Fig. 2. A somewhat larger left valve of an individual presenting characters similar to the preceding.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 3. The right side of a large individual showing the arcuate form characteristic of old individuals.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 4. A left valve of medium size of very short and broad form.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 5. The interior of a left valve of a short and broad form, showing a strong tooth under the beak, with the anterior and posterior muscular scars and connecting pallial line.
Hamilton group. *Delphi, N. Y.*

MODIOMORPHA SUBALATA.

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See Plate 39.

Fig. 6. A right valve of an unusually short and broad specimen.
Hamilton group. *Delphi, N. Y.*

Fig. 7. A right valve of unusually elongate form.
Hamilton group. *Delphi, N. Y.*

MODIOMORPHA PONDEROSA.

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See Plate 34.

Fig. 8. The left side of a cast showing the form and muscular scars.
Corniferous limestone. *Clarence Hollow, N. Y.*

MODIOMORPHA RECTA.

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Fig. 9. The right side of a cast showing the muscular scars and pallial line.
Hamilton group. *Clarke Co., Ind.*

MODIOMORPHA SUBANGULATA.

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Fig. 10. A right valve showing the anterior muscular scar.
Chemung group. *Mansfield, Pa.*

Fig. 11. A smaller right valve showing the muscular scars.
Chemung group. *Mansfield, Pa.*

PLATE XXXV—Continued.

MODIOMORPHA REGULARIS.

Page 270.

Fig. 12. A partial cast of a right valve preserving the surface markings.
Schoharie grit. *Schoharie, N. Y.*

MODIOMORPHA AFFINIS.

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See Plate 37.

Fig. 13. The right side of the specimen described.
Hamilton group. *Onondaga Co., N. Y.*

MODIOMORPHA SCHOHARIE.

Page 269.

See Plate 34.

Fig. 14. The right side of a specimen imperfectly preserving the surface markings.
Schoharie grit. *Schoharie, N. Y.*

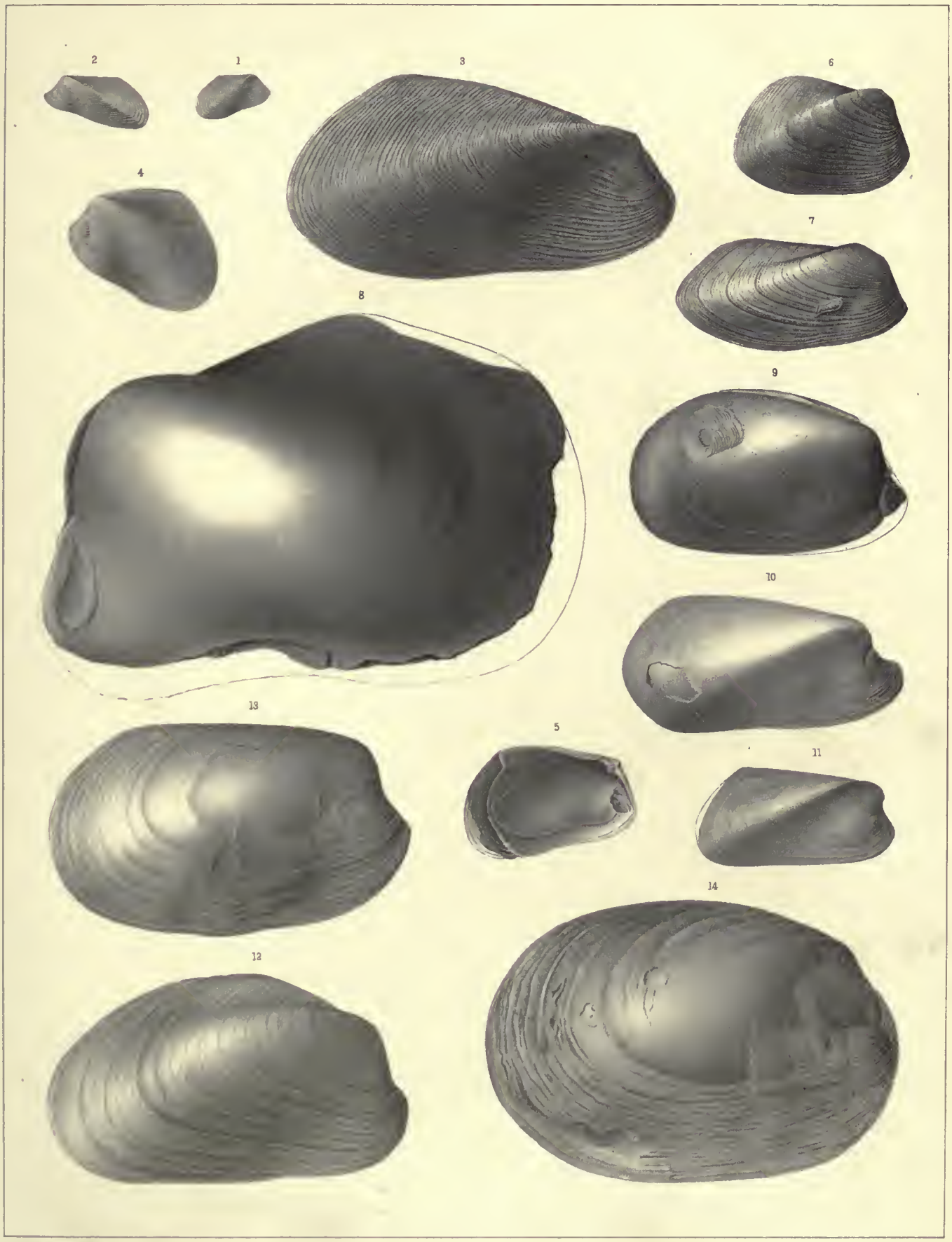
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PLATE XXXVI.

MODIOMORPHA CONCENTRICA.

Page 275.

See Plates 34, 35.

Figs. 1–12. Showing the variety of form, size and surface markings characteristic of the species.
Hamilton group. *Shores of Cayuga, Seneca, Canandaigua lakes and Pratt's falls, N. Y.*

Fig. 13. A cardinal view showing the ligamental area and ligament.

Fig. 14. A partial cast of the interior showing the anterior muscular scar and pallial line.
Hamilton group. *Cumberland, Md.*

Fig. 15. The cast of the interior of a left valve showing muscular scars, pallial line, and the striated hinge area of the opposite valve.

Fig. 16. The interior of the left valve, partially obtained by a gutta-percha impression, showing the strong tooth and the callosity below, with muscular scar and pallial line.
Hamilton group. *Cumberland, Md.*

Fig. 17. A cast of the left valve showing the anterior muscular scar, the cavity of the tooth and the impression of the striated ligamental area.

Fig. 18. A gutta-percha impression from the preceding, showing more clearly the characters of the interior.
Hamilton group. *Schoharie Co., N. Y.*

MODIOMORPHA CYMBULA.

Page 282.

Fig. 19. A cast of the interior of a left valve showing the muscular scars and pallial line.

Fig. 20. A gutta-percha impression from the preceding.
Hamilton group. *East Worcester, N. Y.*

MODIOMORPHA ARCUATA.

Page 281.

Fig. 21. A partial cast of the interior, preserving some of the surface markings and showing the anterior muscular scar.
Hamilton group. *Schoharie Co., N. Y.*

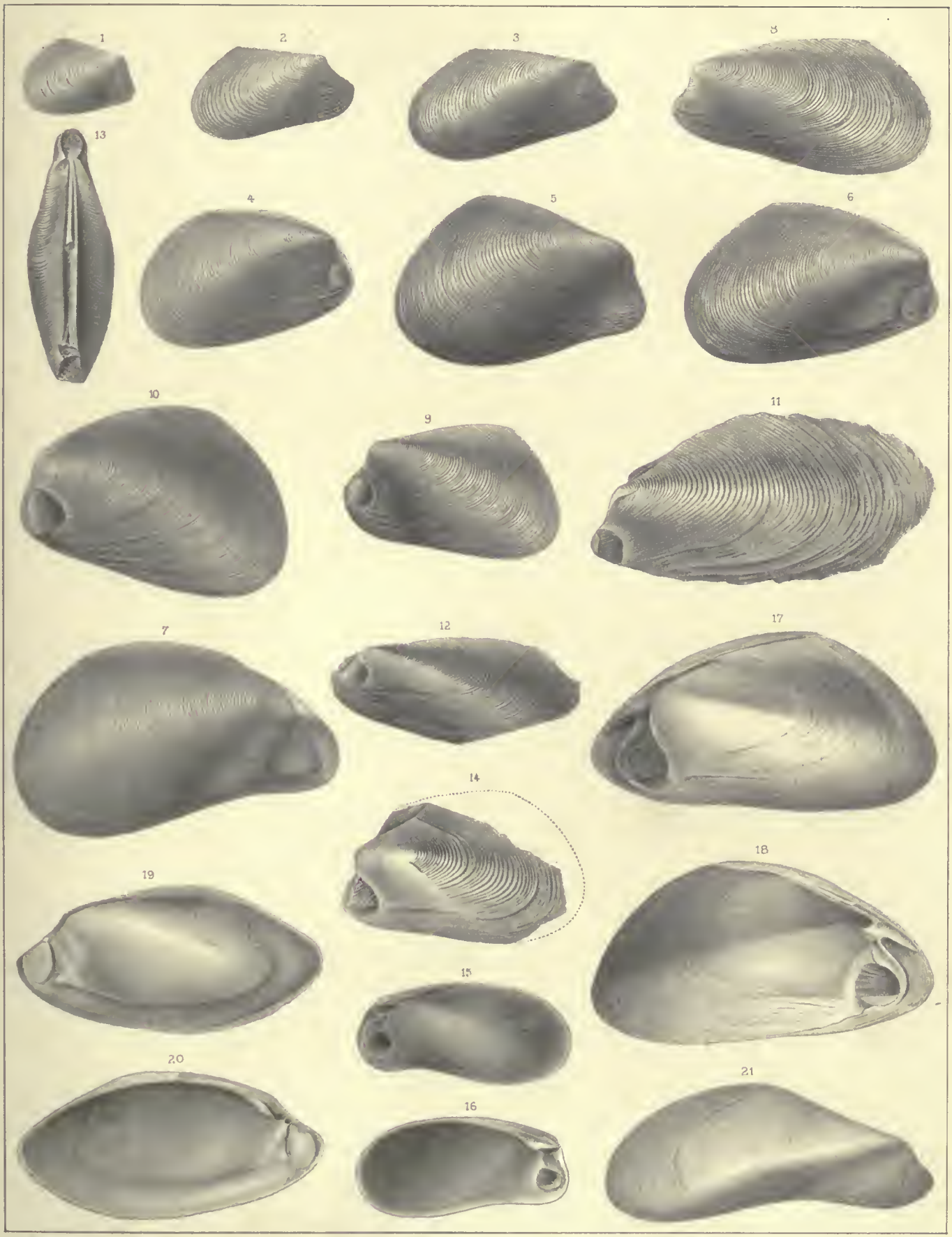
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PLATE XXXVII.

MODIOMORPHA ALTA.

Page 278.

See Plate 80.

Figs. 1, 2, 7–12, 15, 16. These figures represent characteristic specimens of this species in its various phases of growth. Fig. 15 is the type specimen described by Mr. CONRAD.

Hamilton group. *Shore of Seneca lake, N. Y.*

Figs. 4–6 are doubtfully referred to this species, approaching *M. mytiloides* in form.

MODIOMORPHA MYTILOIDES.

Page 277.

See Plate 38.

Fig. 3. A small left valve of this species.

Hamilton group. *Pratt's falls, N. Y.*

MODIOMORPHA AFFINIS.

Page 284.

See Plate 35.

Figs. 13, 14. Right and cardinal views of the specimen described.

Hamilton group. *Onondaga Co., N. Y.*

MODIOMORPHA MACILENTA.

Page 280.

See Plate 39.

Fig. 17. The right side of a crushed specimen.

Hamilton group. *From a boulder of shale in Catherine township, Schuyler Co., N. Y.*

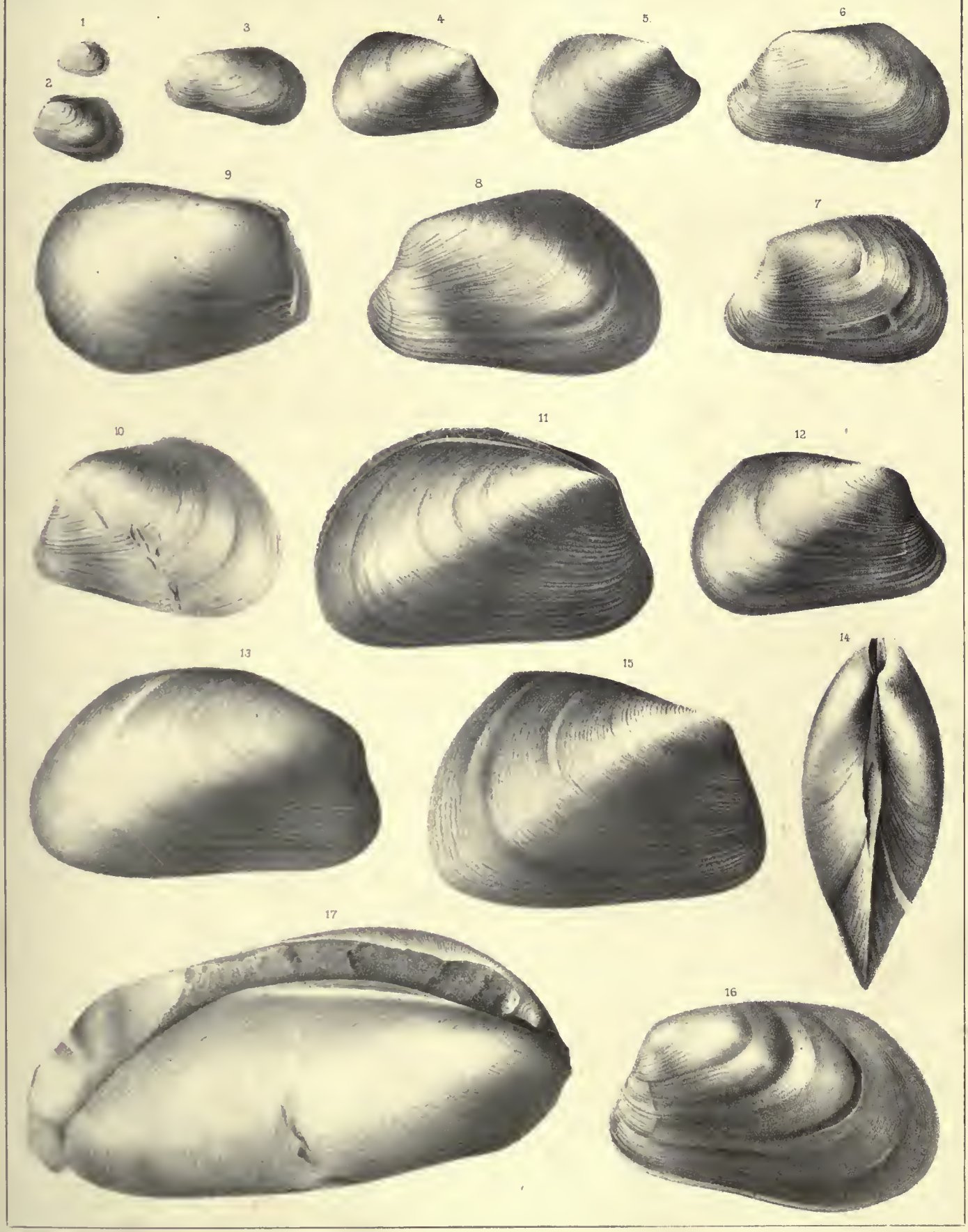
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PLATE XXXVIII.

MODIOMORPHA MYTILOIDES.

Page 277.

See Plate 37.

Figs. 1–16. A series of specimens illustrating the principal varieties of form and surface characters of this species. In fig. 13 the valves are still connected by the ligament.

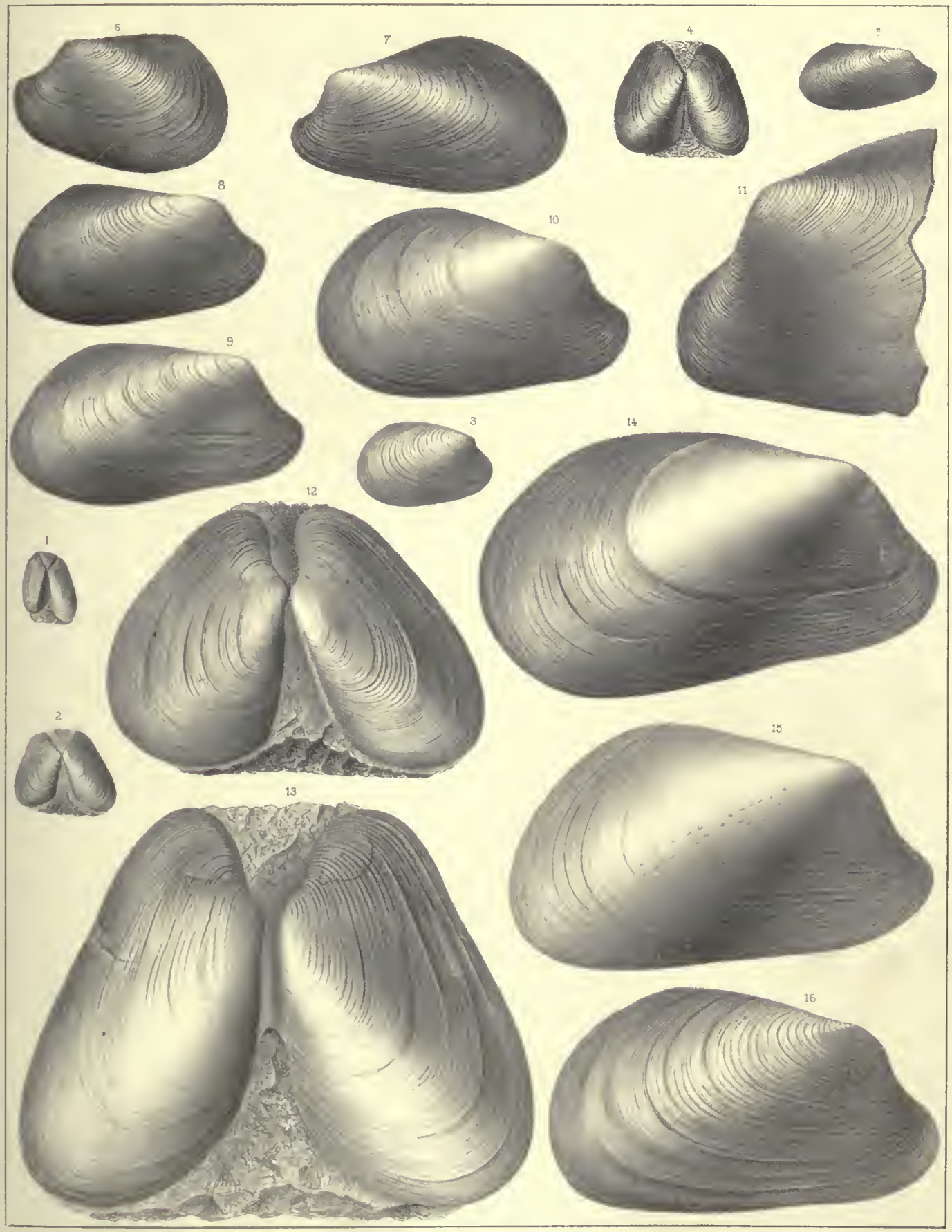
Hamilton group. *Eastern and central New York.*

HAMILTON GROUP.

(MODIOMORPHIDÆ.)

Palæontology N.Y. Vol V

Plate XXXVIII.



G.B. Simpson del.

Riemann lith.

PLATE XXXIX.

MODIOMORPHA SUBALATA.

Page 283.

See Plate 35.

Figs. 1–14, 16. Illustrations showing the phases of this species from the smaller individuals to the larger and full-grown forms.
Hamilton group.

MODIOMORPHA SUBALATA, VAR. CHEMUNGENSIS.

Page 284.

See Plate 41.

Fig. 15. A cardinal view of a crushed specimen.
Chemung group. *Ithaca, N. Y.*

MODIOMORPHA MACILENTA.

Page 280.

See Plate 37.

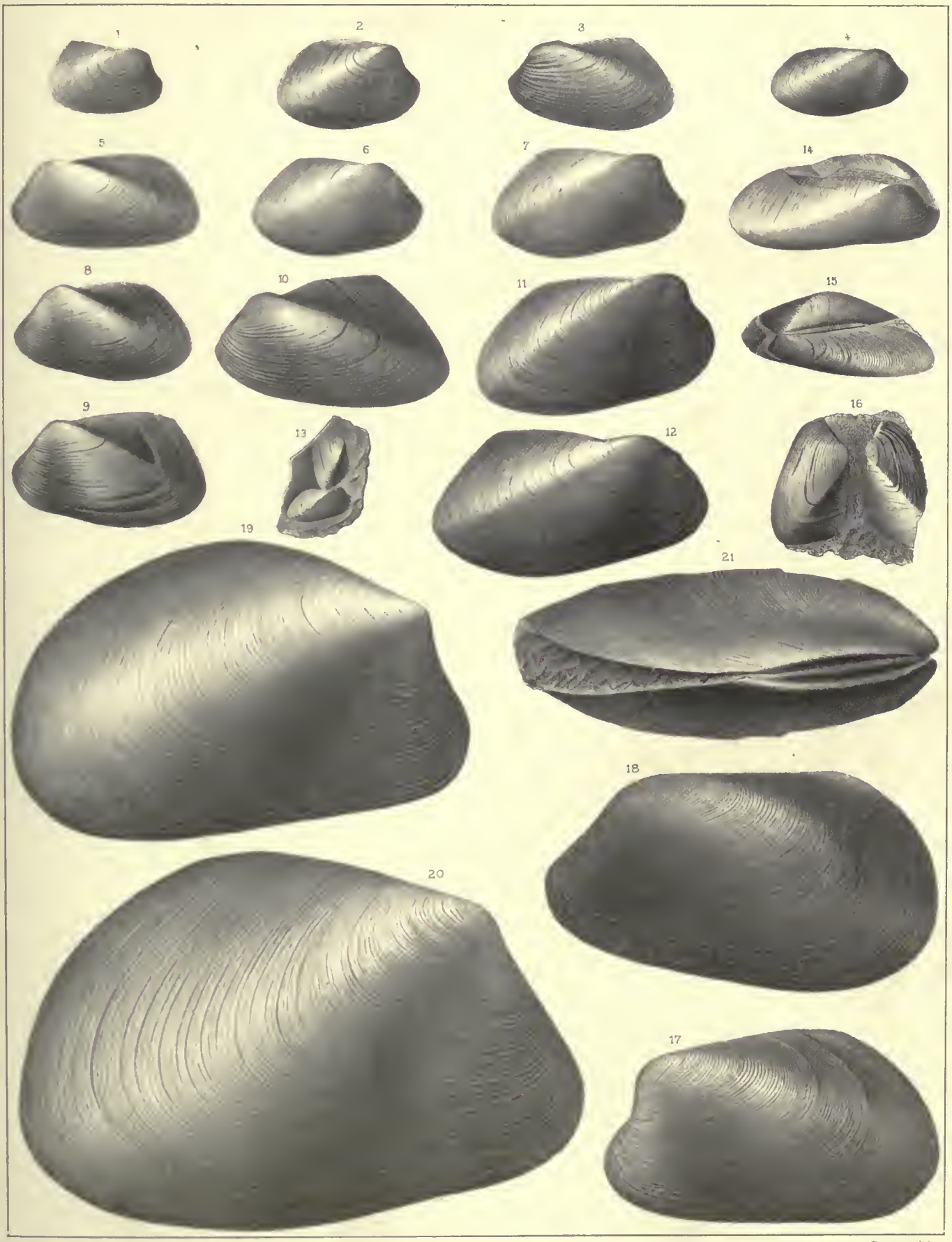
Figs. 17–20. Two small left and two large right valves, fig. 20 representing a specimen of unusual size.
Hamilton group.

Fig. 21. A cardinal view of a crushed specimen showing the ligamental area with the ligament partially preserved.
Hamilton group. *From a boulder of shale in Catherine township, Schuyler Co., N. Y.*

HAMILTON GROUP.

(MODIOMORPHIDÆ.)

Palæontology N.Y. Vol V. Plate XXXIX.



G.B Simpson del. Riemann,lith.

PLATE XL.

Amnigenia Catskillensis.

Page 516.

See Plate 80.

Fig. 1. A vertically compressed specimen, giving a narrow aspect to the valve.
This is the form originally described by Vanuxem as *Cypricardites angustata*.

Figs. 2–4. The ordinary forms of this species.
Oneonta sandstone. *Near Mt. Upton, N. Y.*

Elymella fabalis.

Page 502.

Figs. 5, 9. Two specimens of ordinary size, retaining both valves.
Hamilton group. *Shore of Crooked lake, N. Y.*

Elymella nuculoides.

Page 503.

Figs. 6–8 (10?). Individuals showing the phases of the species as observed in the Hamilton group

Elymella patula.

Page 505.

Fig. 11. A specimen preserving the two valves in conjunction.
Waverly group. *Medina, O.*

Glossites subtenuis.

Page 495.

Figs. 12, 20. Two right valves.
Hamilton group. *Near Geneva, N. Y.*

Glossites amygdalinus.

Page 501.

Figs. 13, 14. A right valve, and a specimen preserving the two valves in conjunction.
Yellow sandstone. *Burlington, Iowa.*

Glossites depressus.

Page 496.

See Plate 96.

Figs. 15, 17. Two left valves of this species.
Chemung group. *Ithaca and Elmira, N. Y.*

Glossites lingualis.

Page 497.

See Plate 96.

Figs. 16, 19. A left and right valve as preserved in soft shales.
Chemung group. *Belmont, N. Y.*

Modiomorpha Tioga.

Page 291.

Fig. 18. A left valve.
Chemung group. *Mansfield, Pa.*

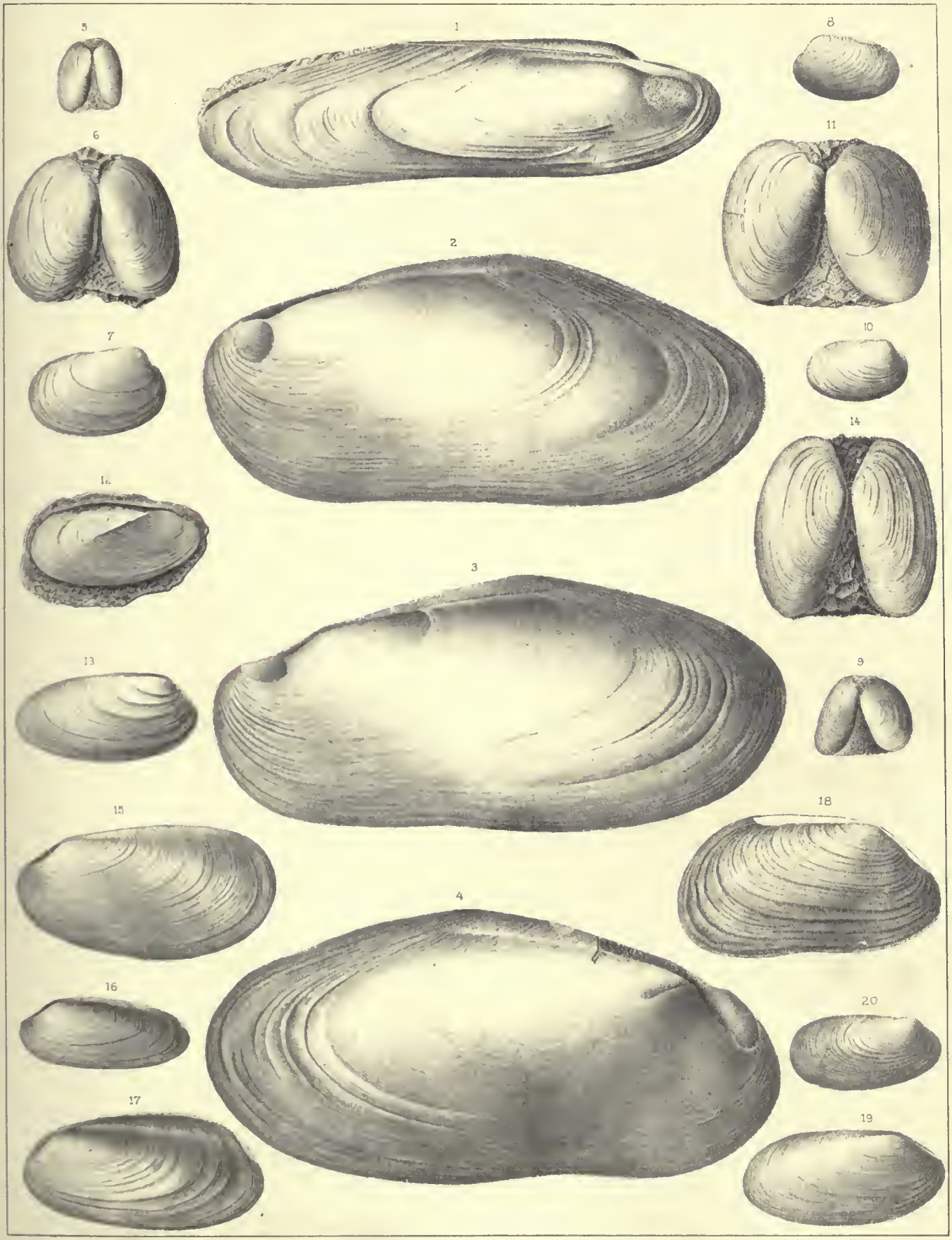

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PLATE XLI.

MODIOMORPHA PUTILLUS.

Page 271.

Figs. 1, 2. Left and cardinal views of a cast.
Schoharie grit. *Schoharie, N. Y.*

MODIOMORPHA COMPLANATA.

Page 272.

See Plate 34.

Fig. 3. The left side of a specimen partially preserving the surface markings.
Corniferous limestone. *Babcock's hill, N. Y.*

MODIOMORPHA CLARENS.

Page 273.

Fig. 4. A right valve.
Corniferous limestone. *Clarence Hollow, N. Y.*

MODIOMORPHA SUBALATA, VAR. CHEMUNGENSIS.

Page 284.

See Plate 39.

Figs. 5, 6. Left and right valves.
Lower Chemung group. *Ithaca, N. Y.*
Fig. 7. A broader form with a convex basal margin, doubtfully referred to this species.
Lower Chemung group. *Ithaca, N. Y.*
Figs. 8, 9. Two specimens retaining both valves.
Lower Chemung group. *Ithaca, N. Y.*
Fig. 10. A left valve.
Lower Chemung group. *Ithaca, N. Y.*
Fig. 11. A right valve, more elongate than the usual form.
Lower Chemung group. *Cortland Co., N. Y.*

LEPTODESMA COMPLANATUM.

Page 227.

See Plate 22.

Fig. 12. A left valve arranged on this plate by mistake. The position of the figure is oblique, and the decurving of the striæ along the hinge is not shown.
Chemung group. *Steuben Co., N. Y.*

MODIOMORPHA NEGLECTA.

Page 290.

Fig. 13. A right valve.
Chemung group. *Near Elmira, N. Y.*

PLATE XLI—Continued.

MODIOMORPHA RIGIDA.

Page 287.

Figs. 14–16. Left valves in their natural form and proportions.
Chemung group. *Alleghany Co., N. Y.*

Fig. 17. A specimen vertically compressed; referred with doubt to this species.
Chemung group. *Belmont, N. Y.*

MODIOMORPHA QUADRULA.

Page 289.

Figs. 18–26. Figures presenting the prevailing varieties of form in this species.
Chemung group. *Alleghany and Cattaraugus counties, N. Y.*

PTYCHODESMA MINOR.

Page 353.

Fig. 27. A right valve of this species.
Chemung group. *Near Elmira, N. Y.*

MODIOMORPHA HYALEA.

Page 292.

Figs. 28–30. Three right valves. In fig. 30 the radii are too strongly represented.
Waverly sandstone. *Granville, O.*

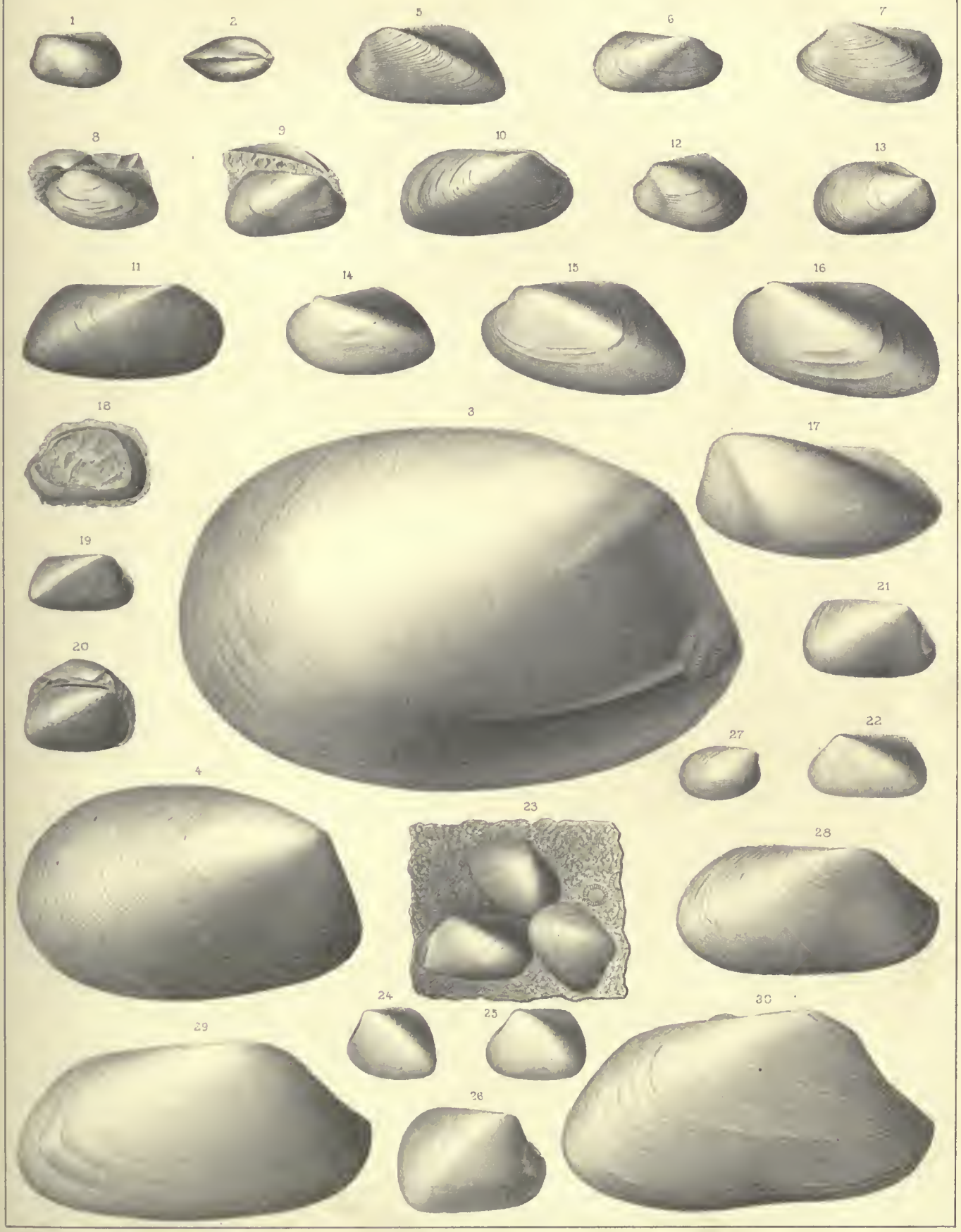
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PLATE XLII.

GONIOPHORA PERANGULATA.

Page 293.

See Plate 34.

Fig. 1. The right side of a small specimen preserving the test and surface markings.

Fig. 2. A cardinal view of a left valve showing the posterior muscular scar, the furrows left by its recession from the beak, and the convexity of the valve.

Schoharie grit. *Schoharie, N. Y.*

GONIOPHORA ? ALATA.

Page 294.

See Plate 34.

Fig. 3. A large right valve, somewhat crushed along the umbonal ridge and preserving some of the stronger concentric striæ.

Schoharie grit. *Schoharie, N. Y.*

GONIOPHORA MINOR.

Page 305.

Fig. 4. A right valve.

Figs. 5, 6. Left valves showing some variation in form.

Chemung group. *Ithaca, N. Y.*

GONIOPHORA RUGOSA.

Page 297.

See Plate 43.

Fig. 7. A short, broad right valve of this species.

Hamilton group. *Shore of Cayuga lake, below Ithaca, N. Y.*

Fig. 8*a*. A short form with a strongly angular and curving umbonal ridge. A right valve of *Microdon* (*Cypricardella*) *bellistriata* is on the same block of stone.

Hamilton group. *Ludlowville, N. Y.*

GONIOPHORA TRUNCATA.

Page 298.

See Plate 44.

Fig. 9. A cardinal view of a right valve.

Fig. 10. A left valve showing muscular scars and pallial line.

Hamilton group. *Pratt's falls, N. Y.*

GONIOPHORA CARINATA.

Page 301.

See Plate 44.

Fig. 11. A right valve showing the principal characters of the species in a very satisfactory manner.

Hamilton group. *Mt. Upton, N. Y.*

GONIOPHORA TRIGONA.

Page 302.

See Plate 44.

Fig. 12. A left valve, redrawn to show more clearly the specific characters than are represented in fig. 9 of plate 44.

Chemung group. *Franklin, Delaware Co., N. Y.*

PLATE XLII—Continued.

GONIOPHORA IDA.

Page 300.

See Plate 65.

Fig. 13. A specimen retaining both valves connected by the hinge ligament.
Hamilton group. *Bellona, N. Y.*

GONIOPHORA SUBRECTA.

Page 304.

See Plate 44.

Figs. 14, 15. Two left valves.
Chemung group. *Charlotteville and Jefferson, Schoharie Co., N. Y.*

MICRODON (CYPRICARDELLA) TENUISTRIATUS.

Page 310.

See Plates 73, 74.

Fig. 16. A cardinal view of a specimen retaining both valves.
Hamilton group. *Cumberland, Md.*

MICRODON (CYPRICARDELLA) BELLISTRIATUS.

Page 308.

See Plates 73, 74.

Fig. 8*b*. A short and broad right valve, showing the hinge and the cardinal teeth.
Hamilton group. *Ludlowville, N. Y.*

Fig. 17. A cardinal view of a small specimen preserving both valves.
Hamilton group. *Cumberland, Md.*

Fig. 18. A specimen showing the valves opened and attached along the hinge-line.
Hamilton group. *Bellona, N. Y.*

Fig. 19. An unusually short and broad form.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 20. An enlargement of the hinge of a right valve.
Hamilton group. *Shore of Seneca lake, N. Y.*

MICRODON (CYPRICARDELLA) MAJOR.

Page 307.

Fig. 21. A right valve showing the form of the shell and the surface markings.
Corniferous limestone. *Delaware, Ohio.*

MICRODON (CYPRICARDELLA) COMPLANATUS.

Page 311.

See Plate 74.

Fig. 22. The left side of a specimen which is a partial cast of the interior, showing the muscular scars and pallial line.
Hamilton group. *Norwich, N. Y.*

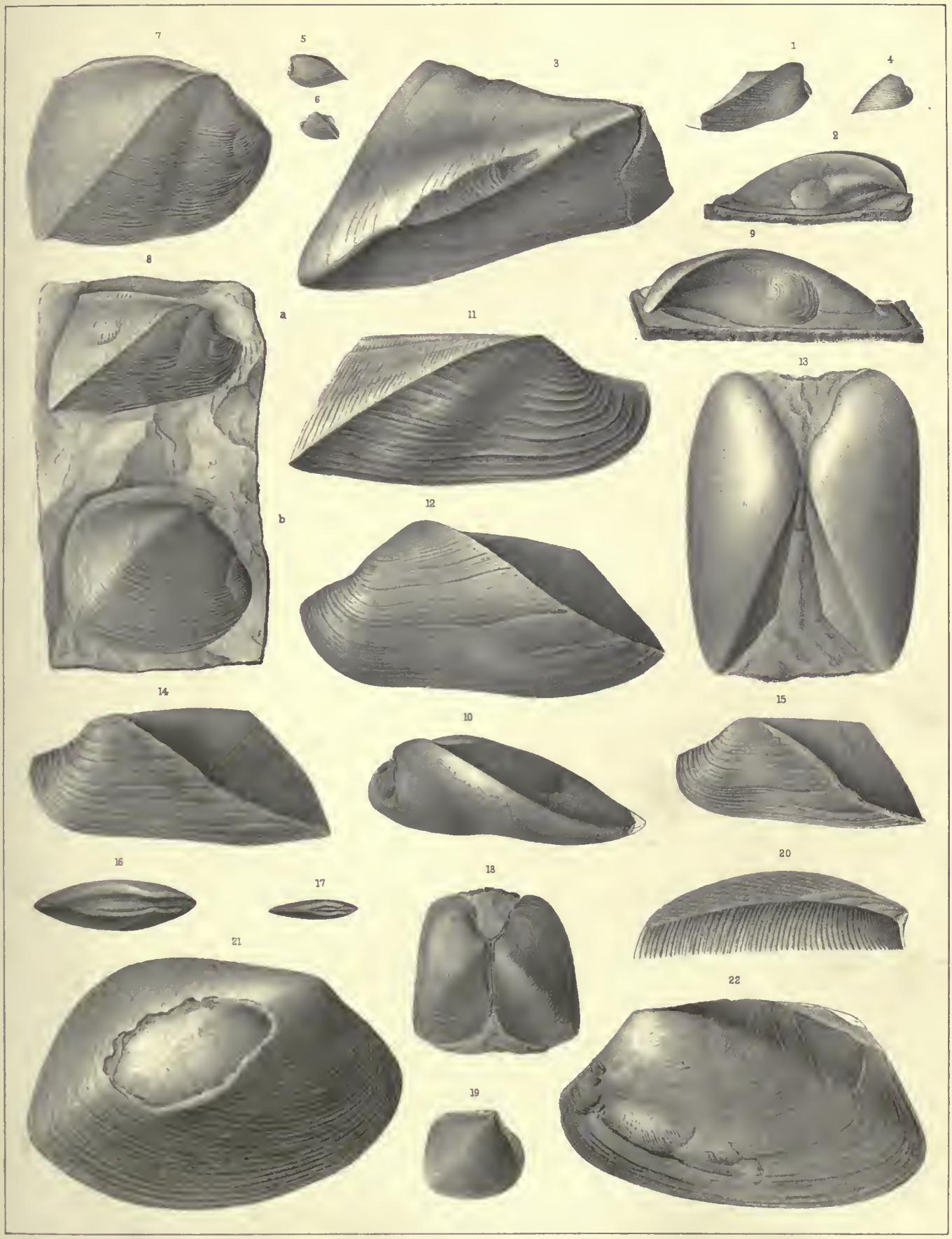
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PLATE XLIII.

GONIOPHORA ACUTA.

Page 295.

Figs. 1, 2. Left valve and cardinal view.

Fig. 3. A cardinal view of two valves in conjunction, somewhat compressed.

Hamilton group. *Shore of Canandaigua lake, N. Y.*

GONIOPHORA RUGOSA.

Page 297.

See Plate 42.

Fig. 4. The left valve of a small individual.

Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 5. A large left valve in its natural form and proportions.

Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 6. A left valve more produced anteriorly than the preceding.

Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 7. A specimen preserving the two valves in conjunction.

Hamilton group. *Schoharie Co., N. Y.*

GONIOPHORA HAMILTONENSIS.

Page 296.

Fig. 8. A right valve below the medium size.

Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Figs. 9–12. A series of young individuals.

Fig. 13. An imperfect right valve preserving a portion of the test and showing the anterior muscular impression.

Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 14. A right valve in its natural proportions.

Hamilton group. *Bear's Gulf, Schoharie Co., N. Y.*

Fig. 15. The two valves in conjunction, the right valve preserving its natural form and proportions.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 17. A cardinal view of a specimen preserving both valves.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 18. A partial cast of a large right valve, showing the imprint of the hinge area.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 19. A gutta-percha impression from the preceding.

Fig. 20. A cardinal view of two valves in conjunction, which are somewhat narrowed by compression.

Fig. 21. A cardinal view of two valves conjoined by the ligament. The specimen is vertically compressed and the cardinal slope flattened.

GONIOPHORA GLAUCUS.

Page 299.

See Plate 44.

Fig. 16. The left side of the specimen partially preserving the shell and showing the anterior muscular impression.

Hamilton group. *Shore of Cayuga lake, N. Y.*

HAMILTON GROUP.

(MODIOMORPHIDÆ.)

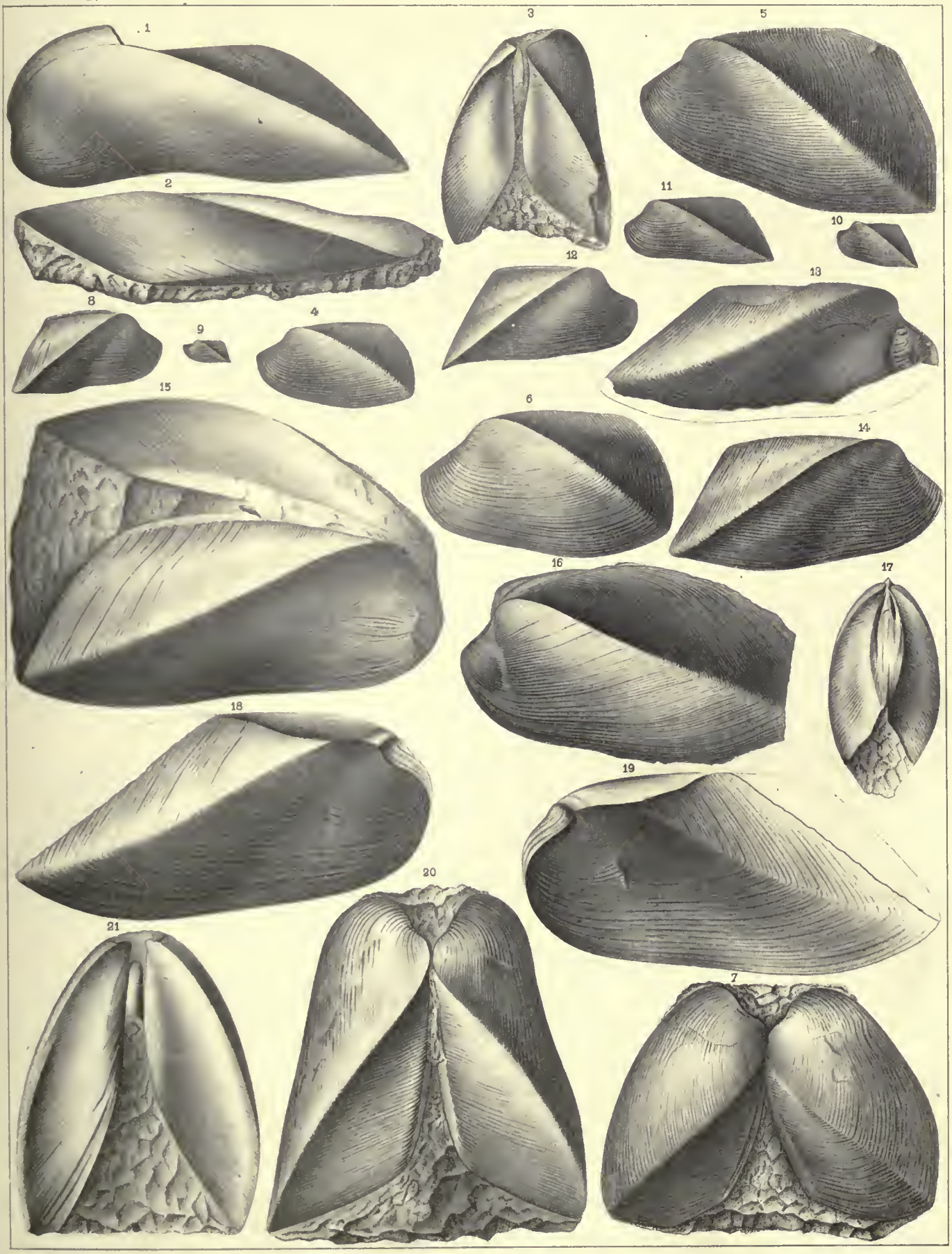

PLATE XLIV.

GONIOPHORA TRUNCATA.

Page 298.

See Plate 42.

Fig. 1. The right side of a crushed specimen showing the surface markings.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 2. The cardinal view of the preceding.

Fig. 3. The right valve of a large individual preserving the surface markings, and showing the natural form of the shell.

Fig. 4. A fragment of a right valve showing the surface markings.
Hamilton group. *Delphi, N. Y.*

Fig. 5. A portion of a right valve from a gutta-percha impression of the natural mould.

GONIOPHORA CARINATA.

Page 301.

See Plate 42.

Figs. 6–8. A series of specimens showing the gradation of form and size.
Hamilton group. *Schoharie and Otsego Co's, N. Y.*

GONIOPHORA TRIGONA.

Page 302.

See Plate 42.

Fig. 9. The left valve described.
Chemung group. *Franklin, Delaware Co., N. Y.*

GONIOPHORA GLAUCUS.

Page 299.

See Plate 43.

Fig. 10. A large right valve in which the cardinal slope is narrowed from compression.

Fig. 11. A right valve.
Hamilton group. *Madison Co., N. Y.*

Fig. 12. A partial cast of a right valve of short form, showing the anterior muscular impression and pallial line. Hamilton group. *Near Apulia, Onondaga Co., N. Y.*

Fig. 13. A cast of the interior of a left valve showing the hinge area, the anterior muscular impression and pallial line.
Hamilton group. *Bear's Gulf, Schoharie Co., N. Y.*

Fig. 14. A gutta-percha impression from the preceding specimen.

Fig. 15. An unusually elongate left valve of this species.
Hamilton group. *Kellogsville, Cayuga Co., N. Y.*

Fig. 16. A cast of a right valve preserving some remains of the shell, and showing the anterior muscular impression and pallial line.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 17. A right valve of a specimen of medium size.
Hamilton group. *Madison Co., N. Y.*

PLATE XLIV—Continued.

Goniophora Chemungensis.

Page 303.

Fig. 18. A right valve.
Chemung group. *Owego, N. Y.*

Fig. 20. A left valve of this species.
Chemung group. *Binghamton, N. Y.*

Fig. 22. A right valve of a large individual.

Goniophora subrecta.

Page 304.

See Plate 42.

Fig. 19. A left valve preserving the usual form.
Chemung group. *Franklin, Delaware Co., N. Y.*

Fig. 21. A left valve of a large individual.

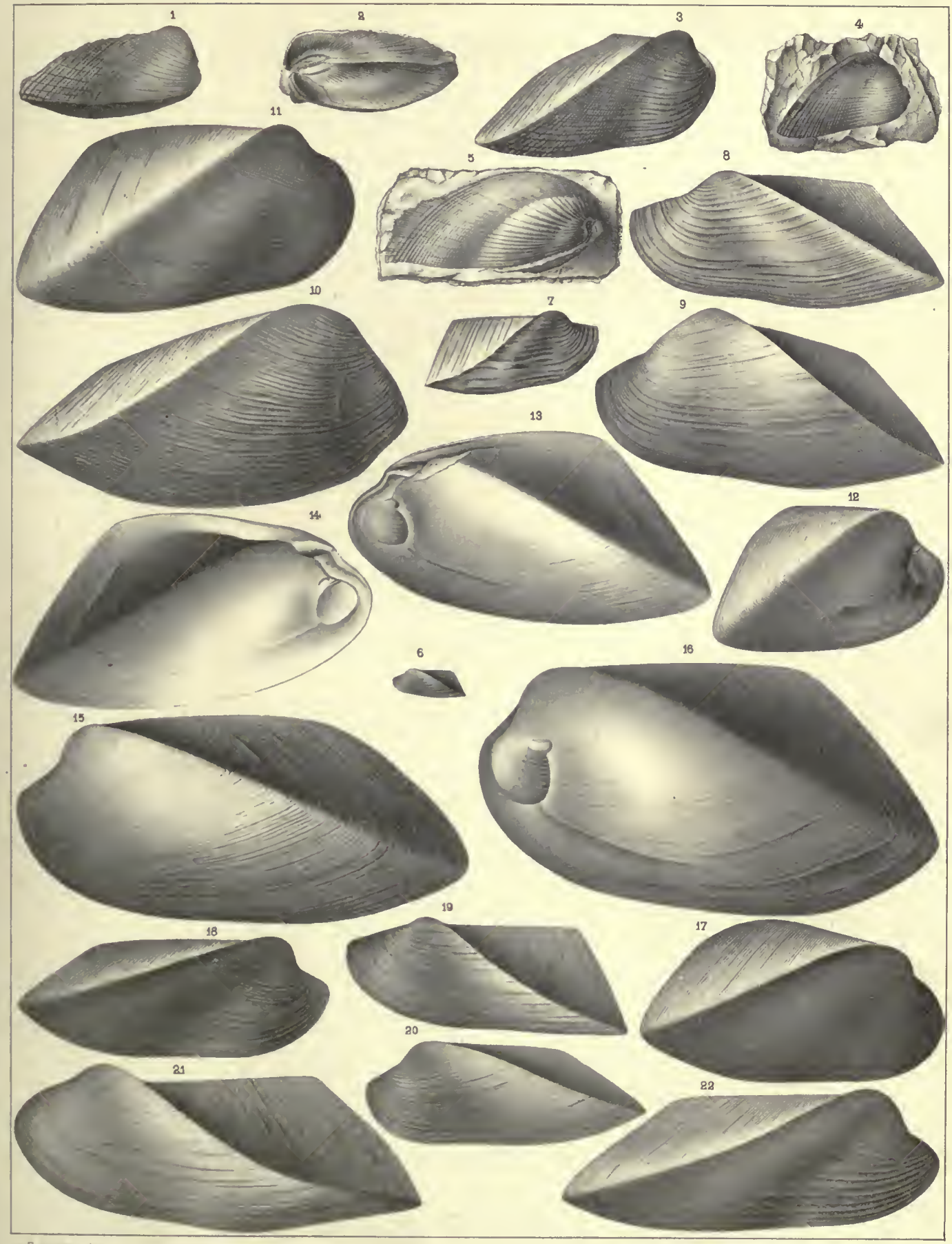
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PLATE XLV.

NUCULA NIOTICA.

Page 313.

Fig. 1. A cast of a right valve showing the muscular scars and umbonal pits.
Fig. 2. A right valve preserving the surface markings.
Hamilton group. *Louisville, Ky.*

NUCULA NEDA.

Page 314.

Fig. 3. A cast of the left valve showing muscular scars and hinge crenulations.
Fig. 4. A cast of a right valve showing muscular scars.
Hamilton group. *Louisville, Ky.*

NUCULA LIRATA.

Page 316.
See Plate 93.

Fig. 5. A right valve showing anterior muscular scars.
Hamilton group. *Hamilton, Madison Co., N. Y.*
Fig. 11. A large right valve.
Hamilton group. *Shore of Seneca lake, N. Y.*
Fig. 15. The left side of a cast showing the muscular scars and hinge crenulations. The crenulations in the figure are continued too far towards the posterior end.
Fig. 17. A right valve more strongly marked than the preceding.
Hamilton group. *Shore of Seneca lake, N. Y.*
Fig. 18. A left valve.
Hamilton group. *Shore of Seneca lake, N. Y.*
Fig. 19. A right valve of gibbous form.
Hamilton group. *Shore of Skaneateles lake, N. Y.*
Fig. 20. A left valve.
Hamilton group. *Shore of Skaneateles lake, N. Y.*
Fig. 21. A left valve enlarged, showing some of the crenulations of the hinge-line.
Hamilton group. *Shore of Owaseo lake, N. Y.*
Fig. 22. The surface of the preceding specimen enlarged.
Fig. 24. A cast of a left valve enlarged, showing muscular scars.
Fig. 25. The cardinal view of the preceding, showing muscular scars and hinge crenulations.

PLATE XLV—Continued.

NUCULA RANDALLI.

Page 315.

See Plate 93.

Figs. 6, 9. Right and cardinal views of a specimen.
Fig. 10. An enlargement of the left side of the preceding.
Figs. 7, 8. Right and left views of another specimen.
Fig. 16. An enlargement from the preceding.
Fig. 23. A cardinal view of a specimen enlarged.
Hamilton group. *Shore of Seneca lake, N. Y.*
Fig. 26. The left side of a cast showing muscular scars and pallial line.
Fig. 27. The cardinal view of the same showing muscular scars and hinge crenulations.
Hamilton group. *Cumberland, Md.*

NUCULA DIFFIDENS.

Page 322.

Fig. 12. A cast of a left valve showing muscular scars and surface striæ.
Lower Chemung group. *Ithaca, N. Y.*
Fig. 14. A left valve, imperfectly preserved, showing surface striæ and posterior muscular scar.
Lower Chemung group. *Ithaca, N. Y.*

NUCULA LAMELLATA.

Page 320.

See Plates 51, 93.

Fig. 13. An enlargement of a left valve of this species, imperfectly represented.
Lower Chemung group. *Ithaca, N. Y.*

NUCULA HOUGHTONI.

Page 323.

Fig. 29. A partial cast of a right valve showing the exterior markings.
Fig. 30. A gutta-percha impression from a cast of a left valve, showing hinge crenulations, muscular scars and pallial line.
Waverly group. *Newark, Ohio.*
Fig. 31. The cast of the interior of a left valve enlarged, showing muscular scars, pallial line, hinge crenulations and cartilage pit.
Waverly group. *Newark, Ohio.*

NUCULA SUBELLIPTICA.

Page 317.

Fig. 28. A cast of a right value, natural size, showing muscular scars.
Hamilton group. *Cumberland, Md.*

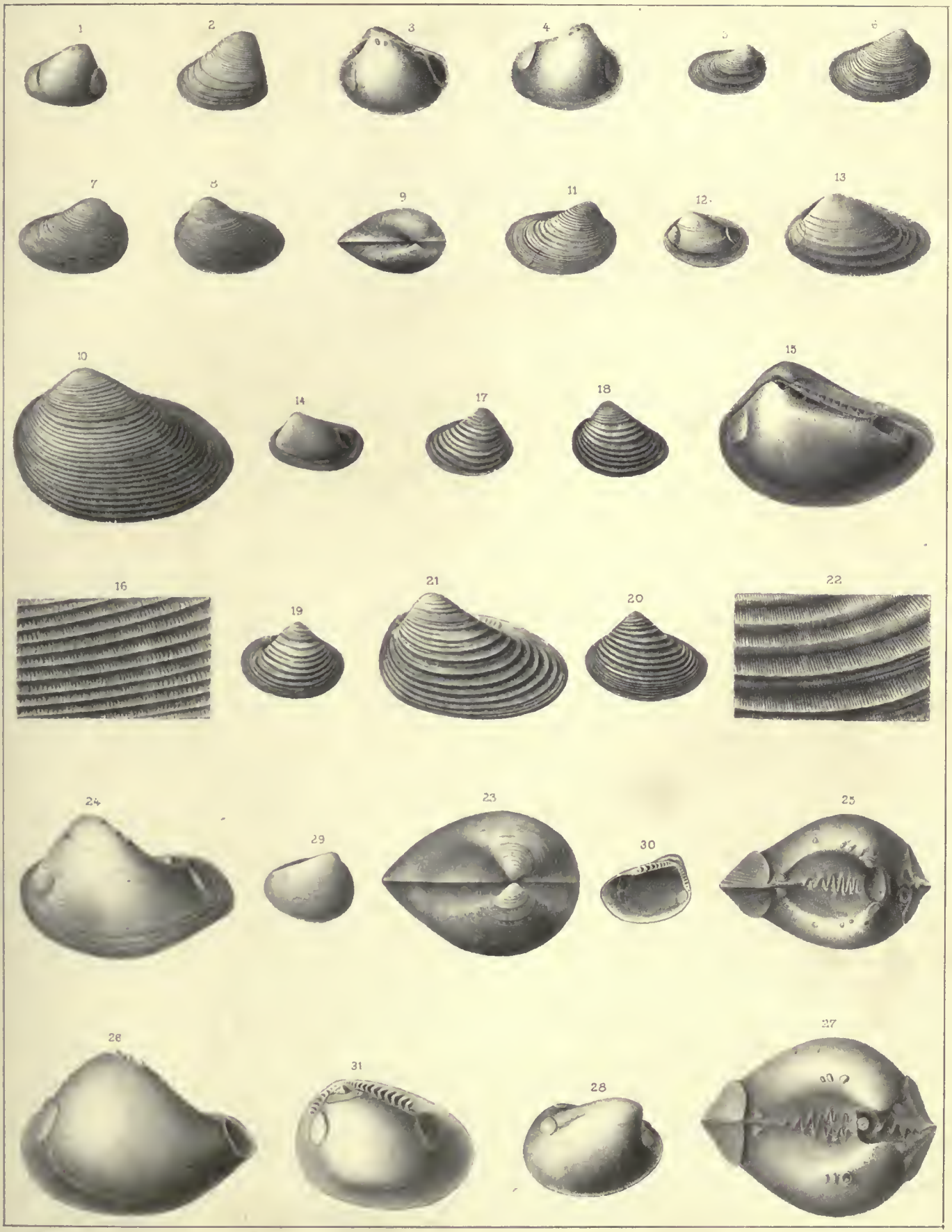
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PLATE XLVI.

NUCULA BELLISTRIATA.

Page 318.

Fig. 1. A right valve, natural size.
Hamilton group. *Delphi, N. Y.*

Fig. 2. A right valve enlarged to two diameters, showing the surface markings and anterior muscular scar. Hamilton group. *Northville, Cayuga Co., N. Y.*

Fig. 3 A right valve of broader form than usual, enlarged.

Figs. 4, 5. Two left valves enlarged, showing the form and surface characters.

Fig. 6. A large left valve, natural size.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 7. A specimen preserving both valves, enlarged.
Hamilton group. *Tinker's falls, Onondaga Co., N. Y.*

Fig. 8. An enlargement of the surface, from fig. 1.

Fig. 9. A cardinal view of a cast, enlarged.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

NUCULA CORBULIFORMIS ?

Page 319.

Figs. 10, 11. Left and cardinal views of a cast of the interior, showing the muscular scars and hinge crenulations.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Figs. 35, 36. Left and cardinal views of a compressed specimen, showing characters similar to the preceding, enlarged to two diameters.

Fig. 37. A partial cast of a right valve of obscure character, enlarged.
Lower Chemung group. *Ithaca, N. Y.*

PLATE XLVI—Continued.

NUCULA VARICOSA.

Page 319.

See Plate 93.

Fig. 12. A left valve, natural size.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 13. An enlargement from the preceding specimen.

Fig. 14. A right valve, natural size, with more prominent umbo and beak than the preceding.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 15. An enlargement from fig. 14.

Figs. 16, 17. Enlargements of left valves.

Fig. 18. An enlargement of a left valve with an unusual gibbosity of the umbo.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 19. A left valve, unusually elongate from the beak to the post-basal extremity, enlarged.

Fig. 20. A right valve of the usual form of the species, enlarged.

Fig. 21. An enlargement from a specimen of unusual length from the beak to the post-inferior extremity.

Fig. 22. An enlargement of the cardinal area showing the fine crenulations of the hinge.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 23. An enlargement from the surface of the specimen, fig. 19.
Hamilton group. *Shore of Cayuga lake, N. Y.*

NUCULA CORBULIFORMIS.

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Fig. 24. An individual, natural size.
Hamilton group. *Shore of Owasco lake, N. Y.*

Fig. 25. A left valve of a larger individual.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 26. A right valve, with the umbo more elevated than usual, partly from compression.
Hamilton group. *Bellona, N. Y.*

Fig. 27. An enlargement from fig. 24, showing more distinctly the surface characters.

Fig. 28. A left valve, enlarged.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 29. An enlargement of a left valve.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 30. An enlargement from fig. 25.

Fig. 31. A right valve, enlarged.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 32. A right valve, enlarged to two diameters.
Hamilton group. *Ludlowville, N. Y.*

Fig. 33. An enlargement of a left valve, which is more equilateral than the prevailing forms.
Hamilton group. *Near Tully, N. Y.*

Fig. 34. An enlargement from fig. 26, showing a few crenulations on the posterior part of the hinge.

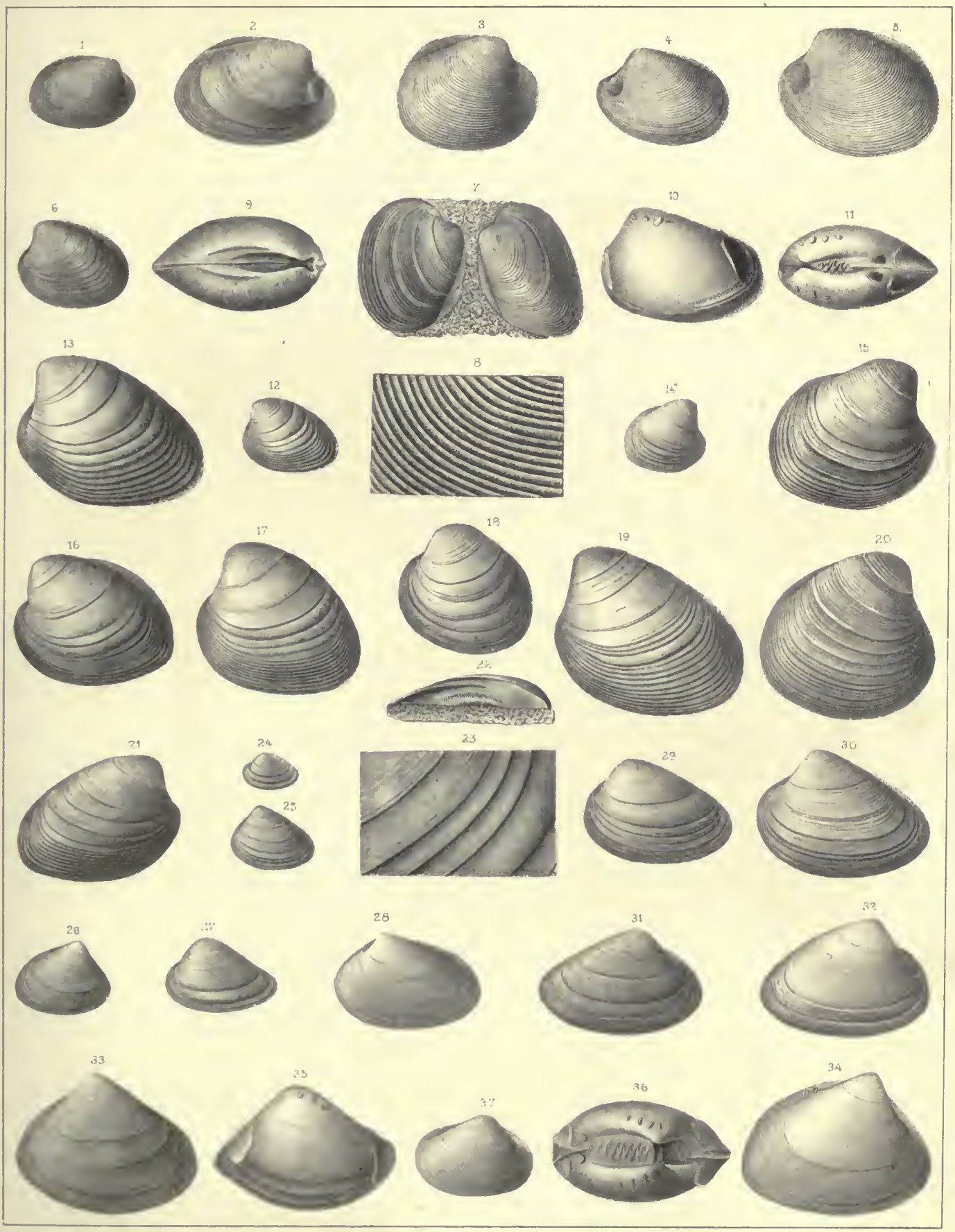
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PLATE XLVII.

NUCULITES OBLONGATUS.

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Fig. 1. The cast of the interior of a left valve, partially preserving the surface striæ.
Hamilton group. *Shore of Otisco lake, N. Y.*

Fig. 2. A cast of the interior of a specimen preserving the two valves in conjunction, and showing the crenulated hinge.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 3. A cast of the interior similar to the preceding.
Hamilton group *Bear's gulf, Schoharie Co., N. Y.*

Fig. 4. A cast of the interior of a right valve, showing the characters of the hinge.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 5. A large specimen similar to the preceding, showing more distinctly the muscular scars and pallial line.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 6. The interior of a right valve as obtained from a gutta-percha impression.

Fig. 7. The interior of a large left valve as obtained from a gutta-percha impression from the natural mould, fig. 9.
Hamilton group. *Near Cumberland, Md.*

Fig. 8. An enlargement from the preceding.

Fig. 9. A cast of a left valve preserving the muscular scars, pallial line and crenulations of the hinge.

Fig. 10. A right valve of short form, preserving the surface striæ.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Figs. 11, 12. Right and cardinal views of a cast of the interior, showing muscular scars and hinge crenulations.
Hamilton group. *Near Cumberland, Md.*

NUCULITES CUNEIFORMIS.

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Fig. 13. A cast of a right valve.
Hamilton group. *Madison Co., N. Y.*

Fig. 14. A right valve, somewhat broader in the anterior portion.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 15. A cast of the interior, preserving the pallial line and some of the surface striæ along the base.
Hamilton group. *Fultonham, N. Y.*

Fig. 16. A small left valve.
Hamilton group. *Jefferson, Schoharie Co., N. Y.*

NUCULITES TRIQUETER.

Page 326.

See Plate 93.

Fig. 17. A cast of a left valve which is unusually acute at the post-inferior extremity.
Figs. 18–22. A series of specimens presenting the usual characters of the species.
Fig. 23. A cast of a left valve showing crenulations on the hinge-line.
Hamilton group. *Cumberland, Md.*
Fig. 24. A gutta-percha impression from the preceding, enlarged to two diameters.
Figs. 25–28. A series of specimens presenting some variations from the typical forms.

NUCULITES NYSSA.

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Figs. 29, 30. Left and right valves.
Hamilton group. *Eighteen-mile creek, N. Y.*

LEDA DIVERSA.

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Figs. 31–37. A series of figures showing variation in form and size, enlarged to two diameters.

LEDA BREVIROSTRIS.

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Figs. 38–41. A series of figures illustrating the varieties of form, enlarged to two diameters.

LEDA ROSTELLATA.

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Figs. 42–46. Present the usual varieties of form in this species. The figures are enlarged to two diameters.
Fig. 47. A right valve, enlarged to three diameters.
Hamilton group. *Pratt's falls, N. Y.*

LEDA OBSCURA.

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Fig. 48. A right valve, enlarged to two diameters.
Hamilton group. *Fultonham, N. Y.*

LEDA PANDORIFORMIS.

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Fig. 49. A cast of a right valve.
Fig. 50. A gutta-percha impression from the preceding showing the characters of the hinge.
Waverly group. *Newark, Ohio.*

NUCULA UMBONATA.

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Figs. 51, 52. Left and cardinal views of a cast.
Chemung group. *Mansfield, Pa.*

SOLEMYA (JANEIA) VETUSTA.

Page 463.

See Plate 94.

Figs. 53–55. Right, left and cardinal views of a characteristic specimen.
Hamilton group. *Near Louisville, Ky.*

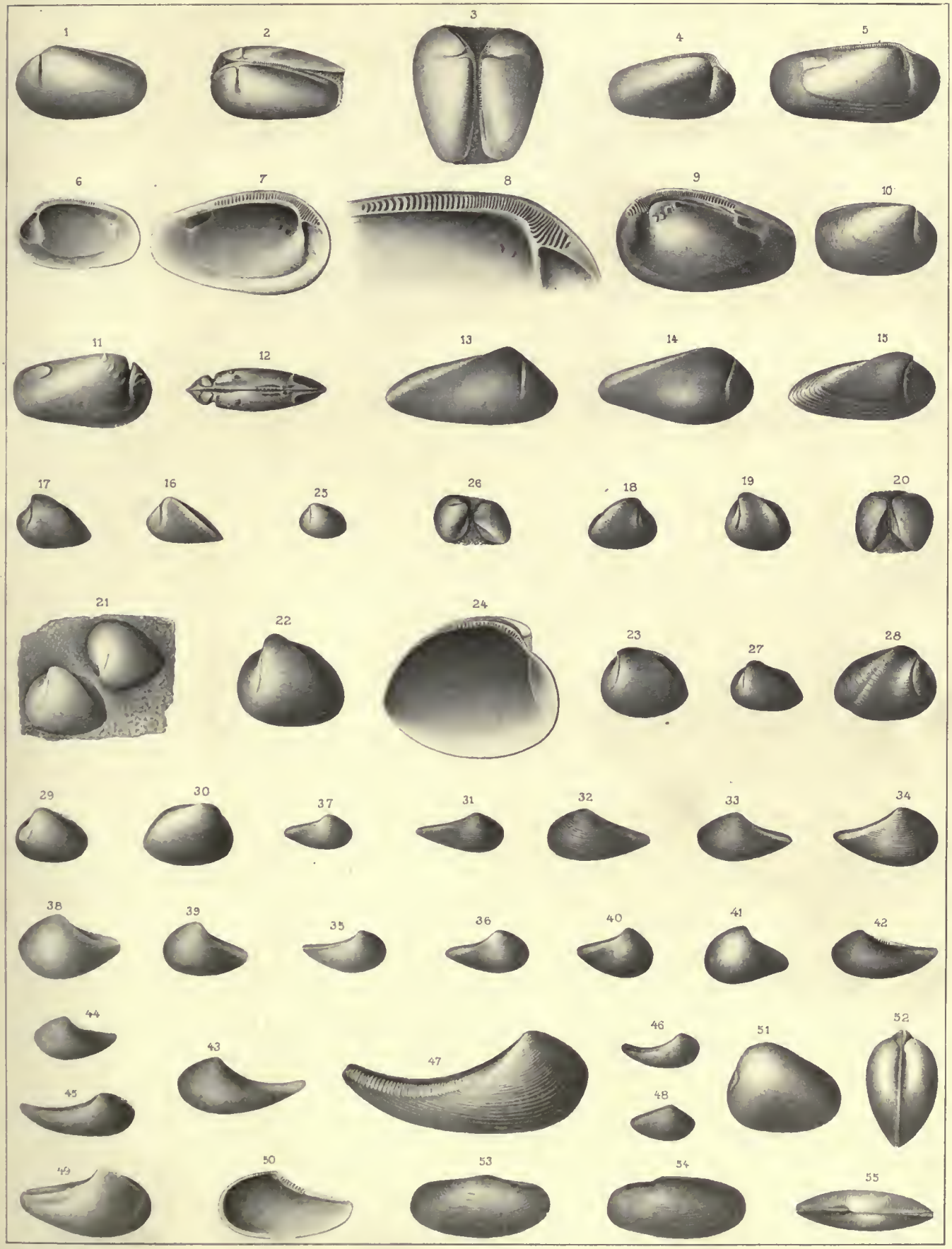
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PLATE XLVIII.

PALÆONEILO CONSTRICTA.

Page 333.

See Plate 51.

Figs. 1–3. Three right valves of somewhat different proportions.
Hamilton group. *Central New York.*

Figs. 4, 5. Two right valves.

Fig. 6. Cardinal view of a cast of the interior.

Fig. 7. An enlargement of a specimen retaining the valves in conjunction.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 8. A left valve enlarged showing the crenulations of the hinge-line.
Hamilton group *Shore of Cayuga lake, N. Y.*

Fig. 9. A cast of a left valve, enlarged to two diameters.
Hamilton group. *Near Cumberland, Md.*

Fig. 10. A gutta-percha impression from the preceding, showing the character of the interior, enlarged.

Fig. 11. An enlargement of the surface from the specimen fig. 8.

Fig. 12. A cast of the interior of a left valve showing muscular impressions and crenulated hinge, enlarged.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 13. A partial cast of a right valve showing the crenulations of the hinge, and preserving the shell and markings along the pallial line, enlarged.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 14. A cast of two valves in conjunction showing the muscular scars and hinge crenulations, enlarged.
Hamilton group. *Near Cumberland, Md.*

Fig. 15. An enlargement of the hinge from the specimen fig. 9.

Fig. 16. A cast of a small individual, somewhat more nasute at the posterior extremity than usual.
Lower Chemung group. *Near Ithaca, N. Y.*

PLATE XLVIII—Continued.

PALÆONEILO CONSTRICTA, var. FLEXUOSA.

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Figs. 17–20. A series of specimens illustrating this variety of form.
Lower Chemung group. *Near Ithaca, N. Y.*

PALÆONEILO PLANA.

Page 334.

Figs. 21–23. Three valves preserving the surface markings on the body of the shell and showing the crenulations of the hinge, enlarged.

Fig. 24. A cast of the interior showing the crenulations of the hinge, enlarged.
Hamilton group. *Tinker's falls, Onondaga Co., N. Y.*

Fig. 25. A cast of the interior of a left valve preserving muscular imprints and hinge crenulations, enlarged.
Hamilton group. *Butternuts, Otsego Co., N. Y.*

Fig. 26. A gutta-percha impression of the preceding, enlarged.

Fig. 27. A cast of a left valve faintly showing the surface striæ and the anterior muscular scar, enlarged.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 28. A left valve presenting a slight variation in form, preserving the surface striæ and showing the crenulations of the hinge, enlarged.
Lower Chemung group. *Ithaca, N. Y.*

PALÆONEILO MAXIMA.

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Figs. 29, 30. Two left valves preserving the surface striæ.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 31. The right side of a cast of a specimen showing the large posterior muscular scar.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 32. A left valve showing an unusual elevation of the umbo from compression.

Fig. 33. A right valve showing a greater height than usual.
Hamilton group. *Fultonham, N. Y.*

Fig. 34. The cardinal view of the specimen fig. 31.

Fig. 35. An unusually short and broad right valve.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 36. The left side of a specimen preserving the two valves in conjunction.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Figs. 37, 38. Enlargements of hinge structure. The crenulations are erroneously represented, especially in fig. 37.

PALÆONEILO ELONGATA.

Page 345.

See Plate 93.

Fig. 39. A left valve showing the fine striæ of growth, enlarged to two diameters.
Chemung group. *Philipsburgh, N. Y.*

HAMILTON & CHEMUNG GROUPS.

(NUCULIDÆ.)

Palæontology N.Y. Vol V. Plate XLVIII.

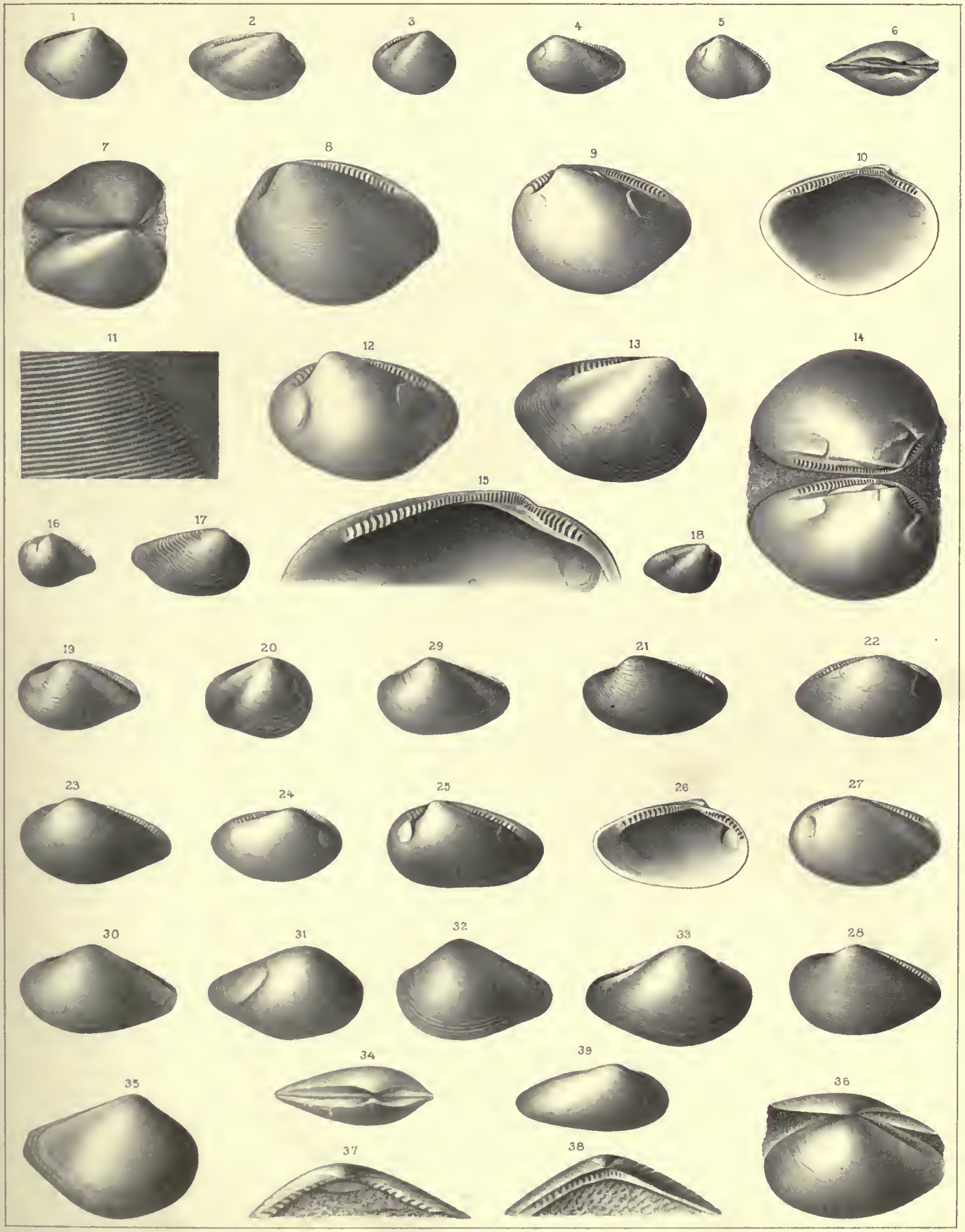

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PLATE XLIX.

PALÆONEILO TENUISTRIATA.

Page 336.

See Plate 93.

Fig. 1. A right valve.
Hamilton group. *Shore of Seneca lake, N. Y.*

Figs. 2, 3. Left side and cardinal view of a specimen of ordinary proportions.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 4. A right valve.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 5. A left valve, proportionally somewhat longer than the preceding.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 6. A specimen retaining both valves, showing the surface markings and crenulations of the hinge.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 7. A right valve preserving the surface markings and showing the crenulations of the hinge.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 8. A right valve similar to the preceding.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 9. An enlargement of the surface from the specimen fig. 2.

Fig. 10. A cast of the interior of a left valve, showing the muscular scars and crenulated hinge.
Hamilton group. *Shore of Lake Erie, N. Y.*

Fig. 11. A cast of the right side of a specimen retaining both valves, showing muscular scars, pallial line and crenulated hinge. The two valves are slightly displaced, making two lines of crenulations.

Figs. 12, 14. Two specimens which are proportionally wider than the prevailing forms.
Hamilton group. *Near Cumberland, Md., and shore of Seneca lake, N. Y.*

PLATE XLIX—Continued.

PALÆONEILO FECUNDA.

Page 336.

Figs. 13, 15–17. Figures illustrating the usual forms in this species.
Fig. 18. A right valve of shorter form.
Hamilton group. *Near Cumberland, Md.*
Fig. 19. The right side of a cast of the interior, showing the muscular scars, pallial line and crenulated hinge. Hamilton group. *Near Cumberland, Md.*
Fig. 20. The left side of a specimen similar to the preceding.
Hamilton group. *Near Cumberland, Md.*
Fig. 21. A gutta-percha impression from the specimen fig. 20.
Fig. 22. An enlargement of a part of the hinge, from the preceding.
Fig. 23. An enlargement of the surface striæ, from the specimen fig. 18.
Fig. 24. The cardinal view of a cast of the interior, showing the crenulated hinge and muscular scars.
Hamilton group. *Near Cumberland, Md.*

PALÆONEILO MUTA.

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Figs. 25, 26. Two valves presenting the ordinary form of the smaller individuals.
Hamilton group. *Bellona and shore of Canandaigua lake, N. Y.*
Fig. 27. A left valve of more elongate form.
Hamilton group. *Shore of Seneca lake, N. Y.*
Fig. 28. A right valve.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Figs. 29, 30. Left and right valves of large individuals.
Fig. 31. A left valve of unusually short form with the concentric lamellæ very strongly developed.
Hamilton group. *Shore of Skaneateles lake, N. Y.*
Fig. 32. An enlargement of the surface, from the preceding.

PALÆONEILO FILOSA.

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Figs. 33–38. A series of right and left valves preserving the usual form of this species.
Lower Chemung group. *Near Ithaca, N. Y.*

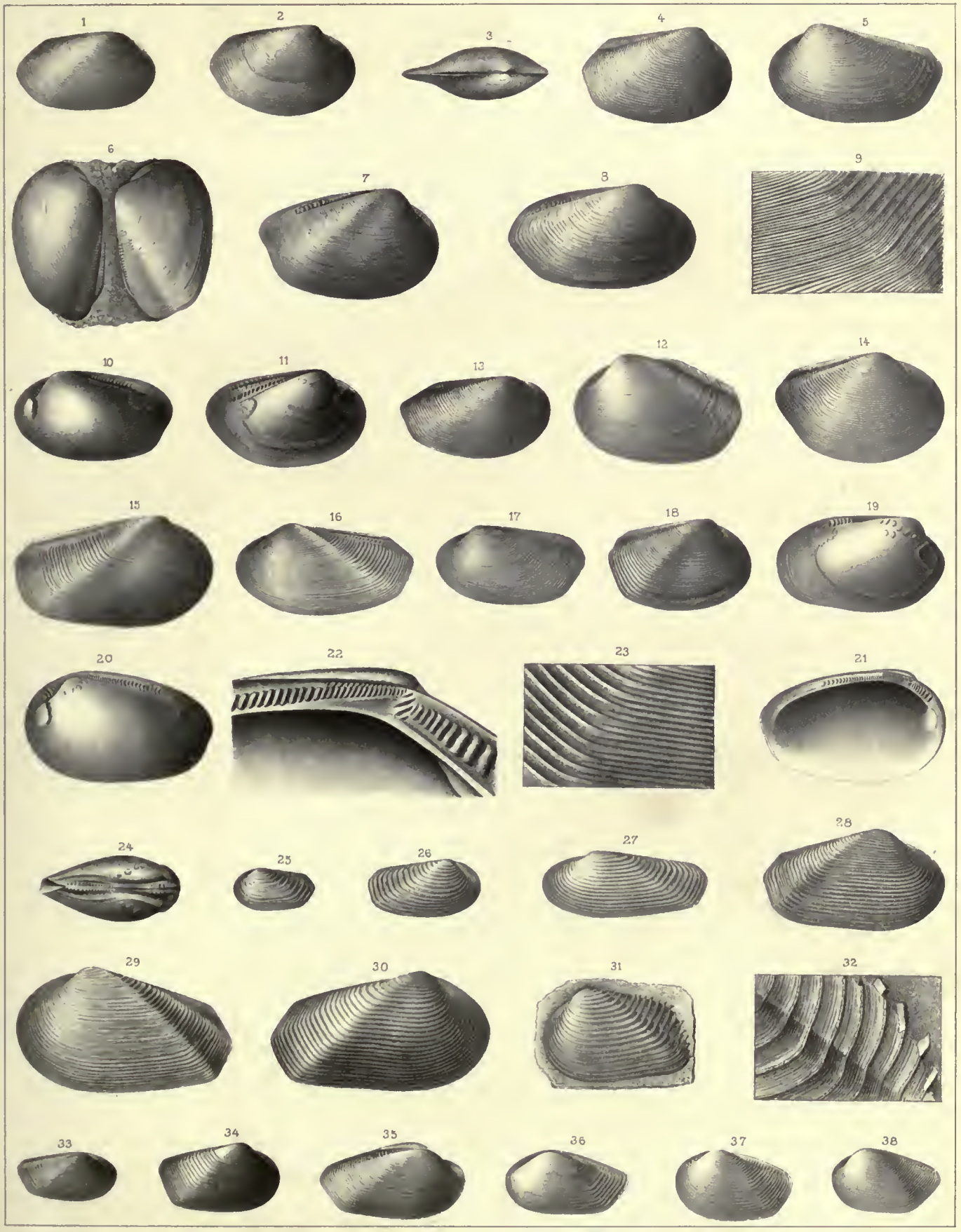
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PLATE L.

PALÆONEILO EMARGINATA.

Page 338.

Figs. 1–6. A series of right valves showing the gradations in size and the prevailing characters of the species.
Hamilton group. *Onondaga, Cayuga and Schoharie Co's, N. Y.*

Figs. 7–10. A series of left valves.
Hamilton group.

Fig. 11. A right valve of a small individual enlarged to two diameters.
Lower Chemung group. *Ithaca, N. Y.*

PALÆONEILO BISULCATA.

Page 344.

Figs. 12–14. A right and two left valves enlarged to two diameters.
Chemung group. *Near Elmira, N. Y.*

PALÆONEILO PERPLANA.

Page 339.
See Plate 93.

Figs. 15–18. A series of left valves, showing gradation in size and variation in form.

Fig. 19. An enlargement of the left valve of an individual with the umbo cut away, showing the crenulated hinge.
Hamilton group. *Ludlowville, N. Y.*

Fig. 20. A specimen retaining the two valves in conjunction.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 21. A large right valve.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 22. A specimen retaining both valves in conjunction.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

PALÆONEILO ARATA.

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Fig. 23. The right side of a specimen retaining the two valves in conjunction.
Hamilton group. *Near Norwich, Chenango Co., N. Y.*

PALÆONEILO BREVIS.

Page 342.

Figs. 24–30. Natural casts of the interior of right and left valves, presenting the general form of the fossils and showing the anterior muscular scar.
Chemung group. *Franklin, Delaware Co., N. Y.* Fig. 30 from *Philipsburgh, N. Y.*

Fig. 31. A specimen preserving the surface markings.
Chemung group. *Philipsburgh, N. Y.*

Fig. 32. A small specimen preserving the surface markings and showing the crenulations of the hinge.
Chemung group. *Philipsburgh, N. Y.*

Fig. 33. A cast of a right valve showing muscular scars.
Chemung group. *Franklin, Delaware Co., N. Y.*

PLATE L—Continued.

PALÆONEILO ATTENUATA.

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Fig. 34. A cast of the interior of a left valve.
Waverly group. *Licking Co., Ohio.*
Fig. 35. The interior of a left valve from a gutta-percha impression of the preceding.
Fig. 36. An enlargement of the same.
Fig. 37. A small individual of this species.
Waverly group. *Newark, Ohio.*
Fig. 38. The cast of a right valve of medium size.
Waverly group. *Newark, Ohio.*
Fig. 39. A cast of an unusually large left valve.
Waverly group. *Newark, Ohio.*

PALÆONEILO TRUNCATA.

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Fig. 40. A small specimen retaining the shell and showing the surface markings.
Waverly group. *Bagdad, Ohio.*
Fig. 41. A large right valve of this species.

PALÆONEILO SULCATINA.

Page 347.

Fig. 42. A left valve.
Waverly group. *Licking Co., Ohio.*
Fig. 43. A cast from the impression of the exterior, showing the character of surface striæ and an unusual truncation at the post-inferior extremity.
Waverly group. *Newark, Ohio.*
Fig. 44. From a gutta-percha impression of the natural mould.
Waverly group. *Licking Co., Ohio.*
Fig. 45. A cast of the interior of a right valve, showing muscular scars and crenulated hinge-line.
Waverly group. *Licking Co., Ohio.*
Fig. 46. A gutta-percha impression from a right valve of this species.
Waverly group. *Richfield, Ohio.*

HAMILTON CHEMUNG & WAVERLY GROUPS.

(NUCULIDÆ.)

Palæontology NY Vol V. Plate L.

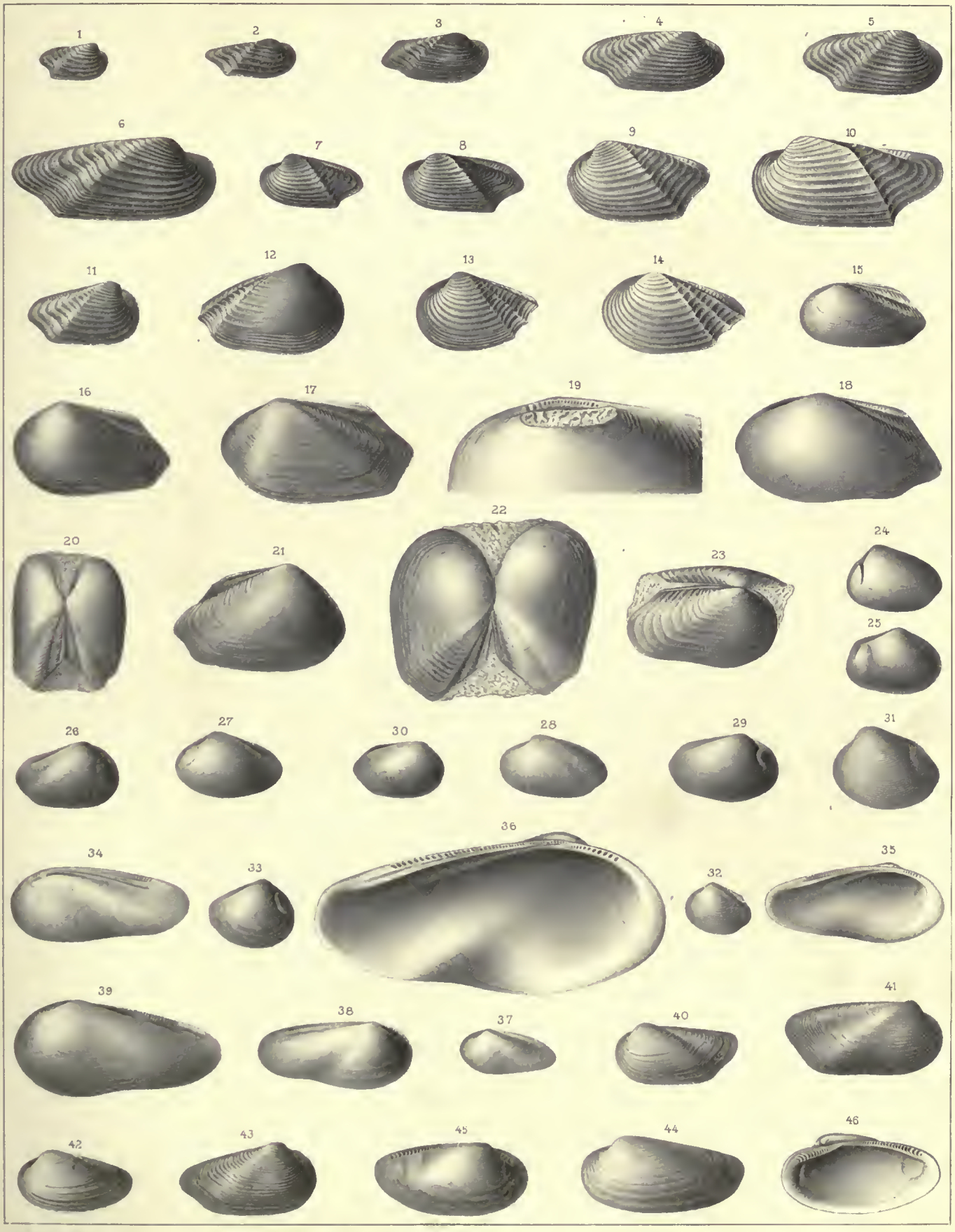

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PLATE LI.

Macrodon Hamiltoniæ.

Page 349.

Figs. 1–4. A series of right valves, showing gradation in size and some slight variation in form.
Fig. 5. A specimen preserving the two valves in conjunction with the test mainly removed.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Fig. 6. A left valve enlarged to two diameters.
Hamilton group. *Shore of Skaneateles lake, N. Y.*
Fig. 7. A similar form from the Waverly group of *Bedford, Ohio.*
Fig. 9. A cardinal view of a cast.
Hamilton group. *Shore of Cayuga lake, N. Y.*
Fig. 10. A left valve of an unusually large individual.
Hamilton group. *Near Cumberland, Md.*

Macrodon ovatus.

Page 351.

See Plate 93.

Fig. 8. A left valve, natural size.
Waverly group. *Granville, Ohio.*

Macrodon Chemungensis.

Page 350.

Fig. 11. A cast of a small left valve.
Chemung group. *Near Elmira, N. Y.*
Fig. 12. A large individual.
Chemung group. *Near Meadville, Pa.*
Fig. 13. A right valve.
Chemung group. *Near Elmira, N. Y.*
Fig. 14. A characteristic left valve.
Chemung group. *Near Elmira, N. Y.*
Fig. 15. A large left valve.
Chemung group. *Near Elmira, N. Y.*
Fig. 16. The left side of a cast with the umbo cut away to show the hinge characters, enlarged.
Chemung group. *Near Meadville, Pa.*

PALÆONEILO CONSTRICTA.

Page 333.

See Plate 48.

Fig. 17. A left valve, enlarged.
Portage group. *Near Portland Harbor, N. Y.*

NUCULA LAMELLATA.

Page 320.

See Plates 45, 93.

Fig. 18. A right valve, enlarged.
Hamilton group. *Shore of Cayuga lake, N. Y.*
Fig. 19. A specimen retaining the two valves in conjunction, enlarged.
Hamilton group. *Shore of Cayuga lake, N. Y.*
Fig. 20. A left valve, enlarged.
Fig. 21. A right valve, enlarged.
Hamilton group. *Shore of Cayuga lake, N. Y.*

PTYCHODESMA KNAPPIANUM.

Page 352.

Figs. 22, 23. Cardinal views of two specimens.
Figs. 24-26. Left and two right valves showing some variation in form.
Fig. 27. An enlargement of one side of the ligamental area.
Hamilton group. *Near Louisville, Ky.*, and *Clarke County, Indiana.*

DYSTACTELLA TELLINIFORMIS.

Page 513.

Figs. 28, 29. Lateral and cardinal views of a small specimen.
Corniferous limestone. *Canada West.*
Fig. 30. A cast of the interior preserving the remains of some concentric undulations. The specimen is imperfect, and is completed in the figure by comparison with other individuals.
Corniferous limestone. *Canada West.*
Fig. 31. A cast of the interior of a specimen.
Corniferous limestone. *Western New York.*

DYSTACTELLA SUBNASUTA.

Page 512.

See Plate 95.

Fig. 32. The left side of a specimen showing muscular scar and pallial line.
Fig. 33. The right side of a specimen preserving the concentric striæ.
Corniferous limestone. *Near Louisville, Ky.*

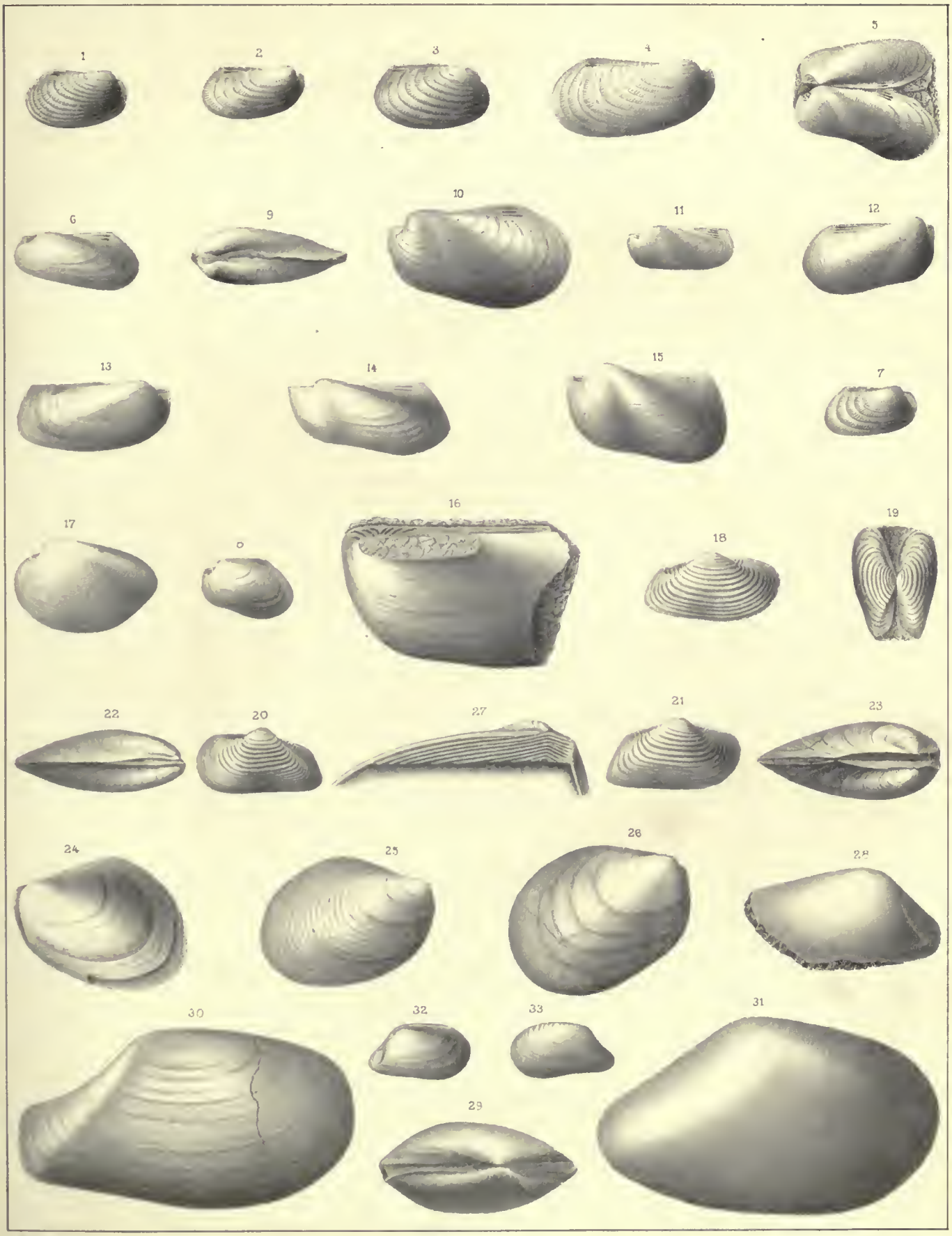
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PLATE LII.

Megambonia cardiiformis.

Page 515.

Fig. 1. A small individual preserving the surface striæ.
Figs. 2, 3. Large specimens of the left valve preserving in a greater or less degree the surface characters.
Figs. 4, 5. Casts of the interior of the right valve preserving some portions of the shell and the surface markings.
Fig. 6. A cardinal view of the specimen illustrated in figs. 2 and 5.
Fig. 7. A cast of the interior of a left valve, showing the anterior muscular impression.
Fig. 8. A gutta-percha impression from the preceding.

Corniferous limestone. *Clarence Hollow, Erie Co., N. Y.*

Megalodon culcullatus, Sowerby.

Fig. 9. The interior of a left valve, showing the muscular impression, teeth and hinge characters.

Devonian. *Paffrath, Germany.*

Megalomus Canadensis, Hall.

Fig. 10. The interior of a left valve showing muscular scar, teeth and hinge characters.

Guelph. *Canada West.*

The figs. 9, 10 are given for comparison with the interior of the corresponding, Megambonia, since generic identity has sometimes been claimed for these genera.

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PLATE LIII.

NYASSA RECTA.

Page 356.

Figs. 1–6. A series of specimens illustrating this species in its gradation of size and modification of form.
Hamilton group. *Schoharie Co., N. Y.*

NYASSA ARGUTA.

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Fig. 7. A cast of the right valve of ordinary form, enlarged to show muscular impression and cardinal line.
Hamilton group. *Pitcher springs, Chenango, Co., N. Y.*

Fig. 8. A gutta-percha impression from the same.

Figs. 9–11. Three left valves.

Figs. 12, 13. Two right valves of this species.

Fig. 14. The cast of the interior of a right valve.
Hamilton group. *Pratt's falls, N. Y.*

Fig. 15. The cast of the right valve showing muscular scars, pallial line and hinge characters.
Hamilton group. *Pratt's falls, N. Y.*

Fig. 16. A gutta-percha impression from the preceding.

Fig. 17. A cast of a right valve of an unusually large individual.
Hamilton group. *Otsego Co., N. Y.*

Fig. 18. A gutta-percha impression from the preceding specimen.

Fig. 19. A portion of the hinge of the same greatly enlarged.

Fig. 20. A cast of a right valve, showing a strong anterior muscular scar, pallial line and cardinal folds beneath the beak.
Hamilton group. *Otsego Co., N. Y.*

NYASSA SUBALATA.

Page 355.

Figs. 21–25. Right and left valves, showing the usual variety of form, the anterior muscular scar and pallial line.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 26. A smaller left valve which has developed distinct radii upon the posterior slope.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

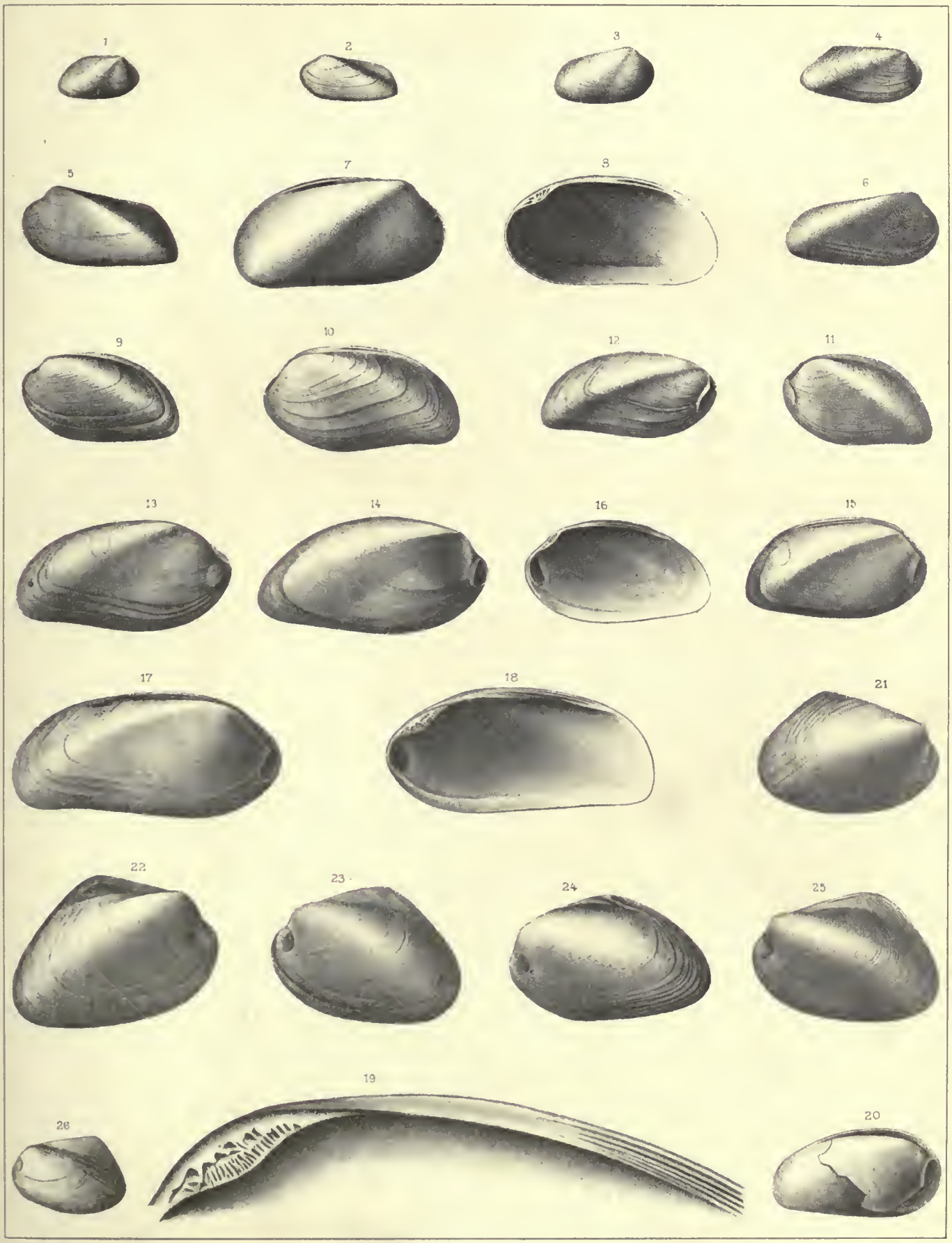
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PLATE LIV.

GRAMMYSIA BISULCATA.

Page 359.

See Plates 56, 93.

Figs. 1–5. Young and medium-sized specimens presenting the usual characters of this fossil.

Fig. 6. A left valve in which the stronger folds are obsolete, presenting characters which are partially shown in figs. 4 and 5.

Fig. 7. The left side of a large individual preserving the usual characters.
Hamilton group. *Madison Co., N. Y.*

Figs. 8, 9. Left side and anterior view of a partial cast preserving the natural form.
Hamilton group. *Madison Co., N. Y.*

Fig. 10. A specimen preserving the two valves in conjunction.

Fig. 11. The right side of a specimen which has been vertically compressed.
Hamilton group. *Madison Co., N. Y.*

Fig. 12. The right side of a flattened specimen showing the valves retained in conjunction by the hinge ligament.

Fig. 13. The left side of a smaller individual.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 14. A specimen preserving the two valves in conjunction.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 15. An unusually large individual preserving the two valves in conjunction with the ligament partially preserved.
Hamilton group. *Geneseo, Livingston Co., N. Y.*

Fig. 16. A specimen preserving both valves and having an unusually rotund form. See fig. 1 of plate 56.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

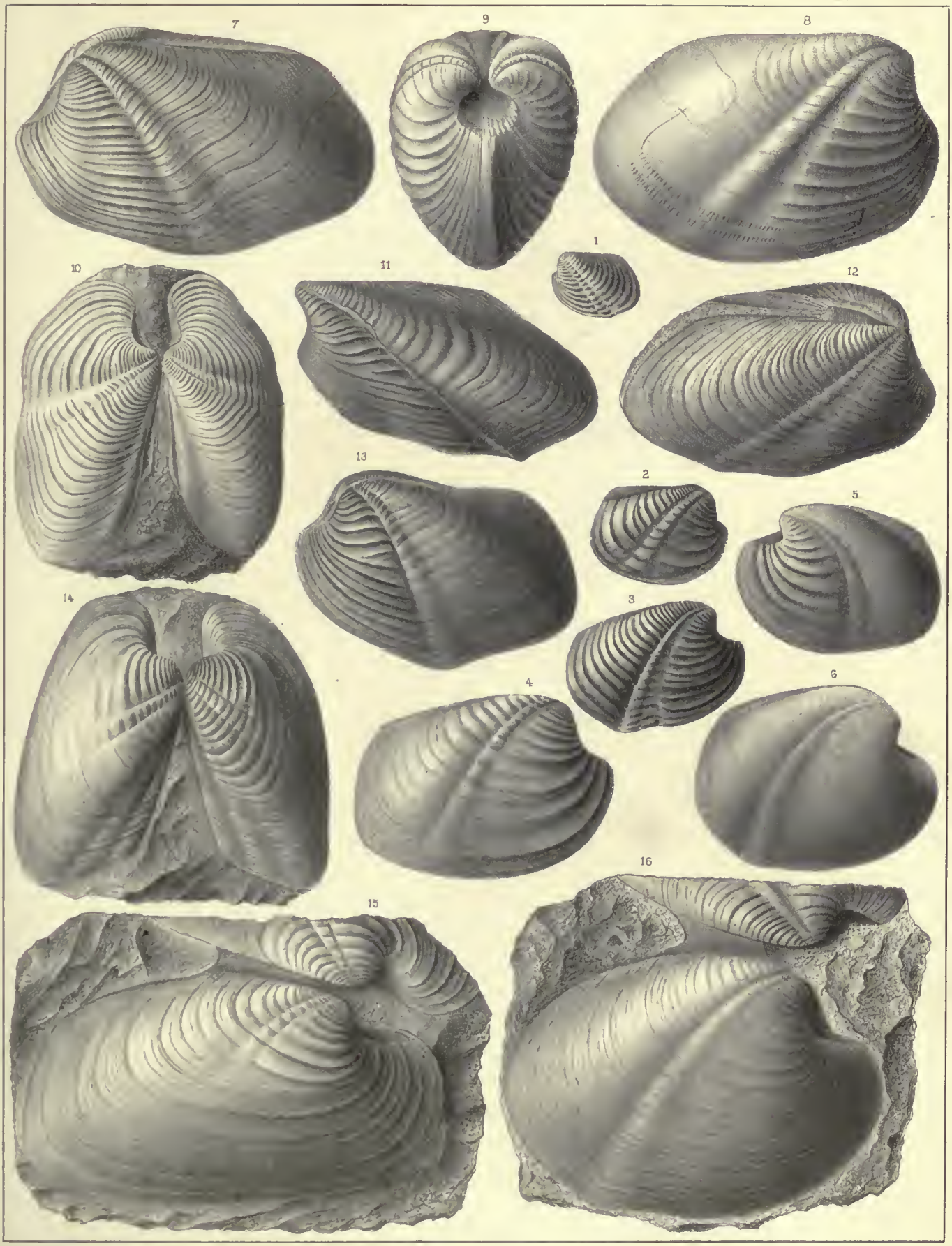
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PLATE LV.

GRAMMYSIA NODOCOSTATA.

Page 360.

See Plates 56, 57, 96.

Fig. 1. A small specimen preserving both valves and showing the characteristic ornamentation.
Hamilton group. *Madison Co., N. Y.*

Figs. 2–4. Anterior, posterior and cardinal views of a specimen vertically compressed.
Hamilton group. *Madison Co., N. Y.*

Figs. 5, 6. Left side and cardinal view of a small individual, showing the surface ornaments in a very satisfactory manner.

Figs. 7–9. Left, anterior and posterior views of a large specimen which is vertically compressed, making the valves much narrower and deeper than natural.
Hamilton group. *Madison Co., N. Y.*

Fig. 10. A fragment of a left valve preserving the surface ornaments.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 11. An enlargement from the surface of the preceding.

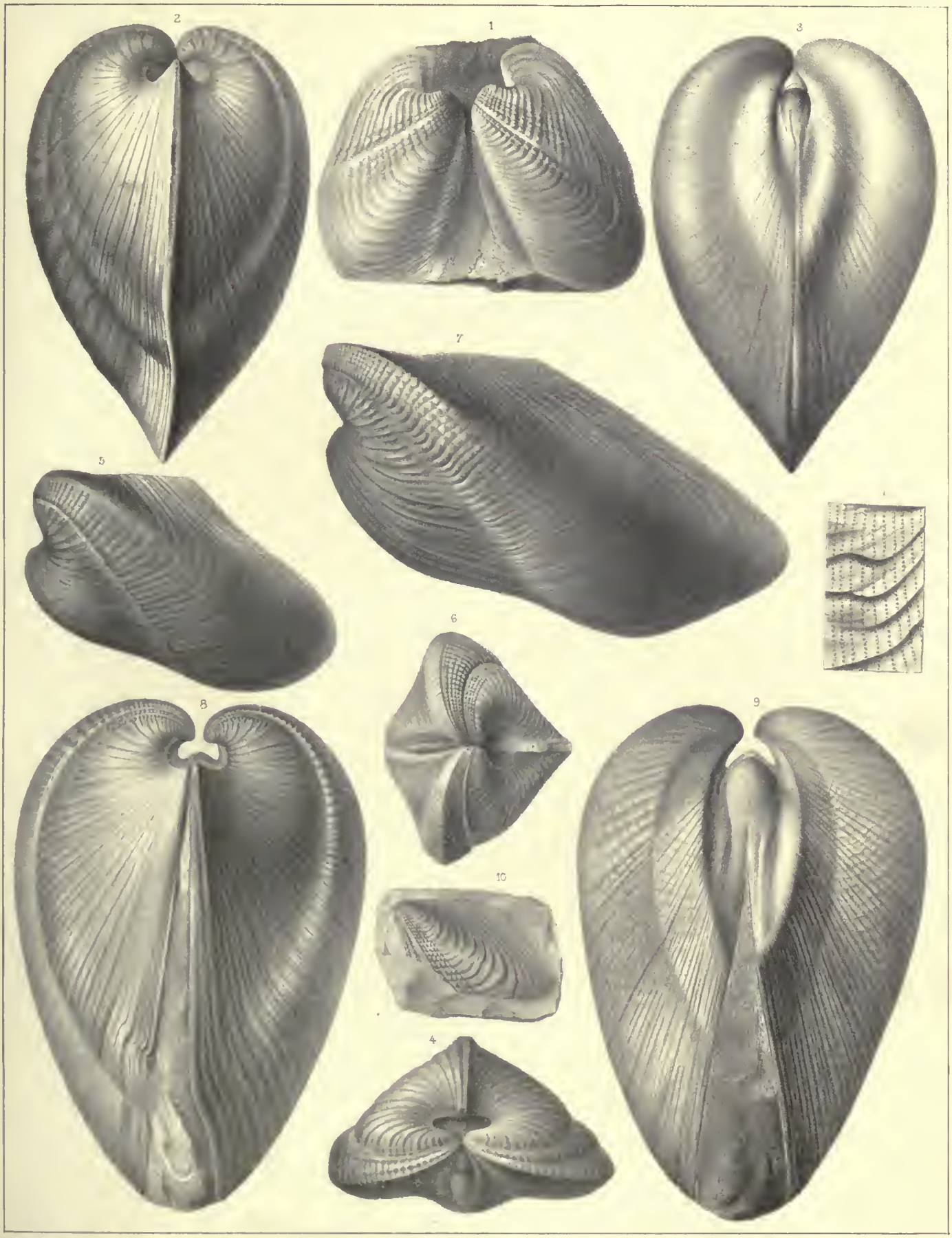
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PLATE LVI.

GRAMMYSIA BISULCATA.

Page 359.

See Plates 54, 93.

Fig. 1. A left valve of a large individual of broad form.
Hamilton group. *Ludlowville, N. Y.*

GRAMMYSIA NODOCOSTATA ?

Page 360.

See Plates 55, 57, 96.

Figs. 2, 3. The right and left sides of a specimen which is obliquely compressed and distorted.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

GRAMMYSIA MAGNA.

Page 362.

See Plate 57.

Fig. 4. The right side of a partial cast of the interior.
Hamilton group. *Madison Co., N. Y.*

Fig. 5. The right side of a specimen preserving the two valves in conjunction.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 6. A large left valve which is a partial cast of the interior, preserving only the finer striæ.

Fig. 7. A partial cast of a right valve preserving on the middle and anterior portions the stronger undulations.
Hamilton group. *Schoharie Co., N. Y.*

GRAMMYSIA ERECTA.

Page 363.

See Plate 57.

Fig. 8. An imperfect right valve preserving the umbonal and anterior portion.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

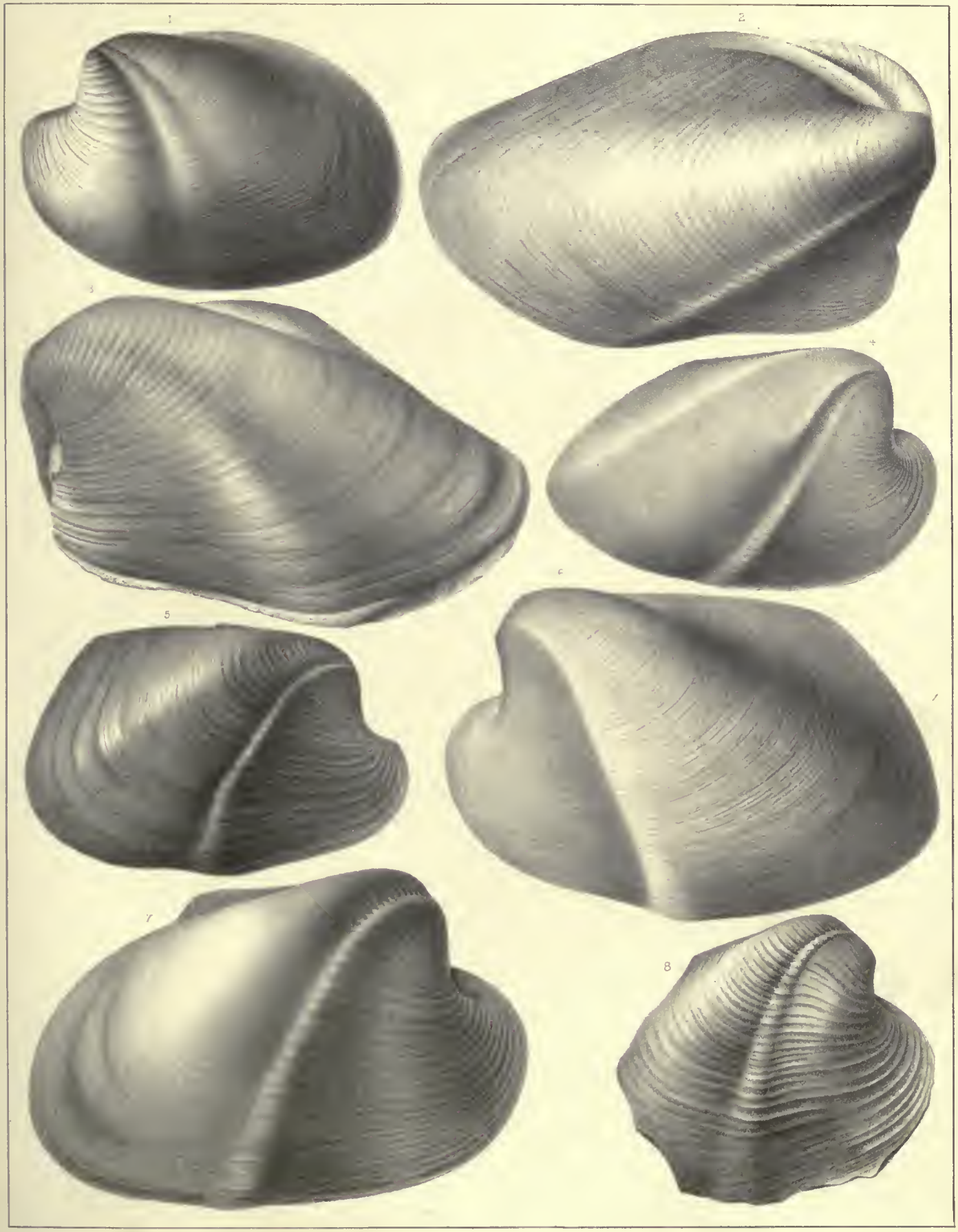
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PLATE LVII.

GRAMMYSIA ALVEATA.

Page 370.

See Plate 60.

Fig. 1. Cardinal view of a specimen vertically compressed.
Hamilton group. *Chenango Co., N. Y.*

Fig. 2. The ventral view of a specimen vertically compressed.
Hamilton group. *Madison Co., N. Y.*

GRAMMYSIA CIRCULARIS.

Page 364.

See Plate 58.

Fig. 3. Two valves in conjunction which have been partially denuded of the shell, showing muscular scars and pallial line.

Fig. 4. The right side of a cast of the interior showing muscular scars and pallial line.

Fig. 5. Anterior view of the same specimen.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 6. Anterior view of a specimen somewhat vertically compressed.
Chemung group. *Ithaca, N. Y.*

GRAMMYSIA NODOCOSTATA.

Page 360.

See Plates 55, 56, 96.

Figs. 7, 8. Cardinal view and right side of a large individual.
Hamilton group. *Madison Co., N. Y.*

GRAMMYSIA MAGNA.

Page 362.

See Plate 56.

Fig. 9. View of a crushed specimen, showing the escutcheon and ligamental area with a portion of the ligament.
Hamilton group. *Pompey, Onondaga Co., N. Y.*

GRAMMYSIA ERECTA.

Page 363.

See Plate 56.

Fig. 10. The umbonal and anterior portion of a right valve.
Hamilton group. *Near Bear's gulf, Schoharie Co., N. Y.*

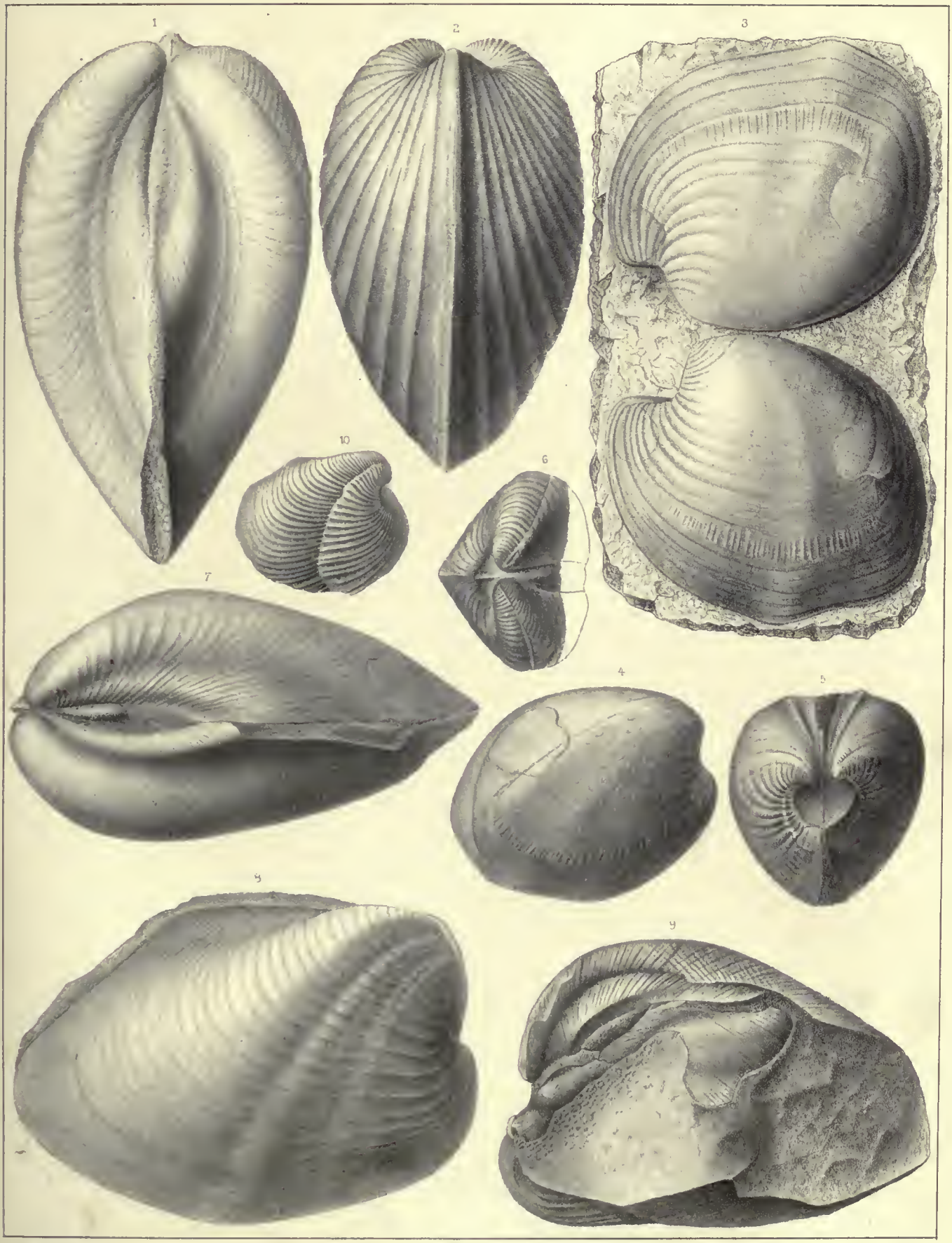
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PLATE LVIII.

Grammysia elliptica.

Page 365.

Fig. 1. A small left valve of unusually rotund form, referred to this species with some doubt.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 2. A left valve of the usual form and proportions.
Chemung group *Alleghany Co., N. Y.*

Fig. 3. A right valve similar to the preceding.
Chemung group. *Philipsburgh, N. Y.*

Fig. 4. A right valve.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 5. A left valve similar in form to fig. 1, and also referred with doubt to this species.

Fig. 6. The opposite side of the preceding, showing the escutcheon and hinge.
Chemung group. *Philipsburgh, N. Y.*

Fig. 7. The left side of a specimen.
Chemung group. *Mansfield, Pa.*

Figs. 8, 9. Two left valves of young individuals.
Chemung group. *Philipsburgh, N. Y.*

Fig. 10. A large right valve.
Chemung group. *Mansfield, Pa.*

Fig. 11. The anterior portion of a large right valve of unusually erect form.
Chemung group. *Mansfield, Pa.*

Fig. 12. The hinge of a right valve showing the ligamental area and cardinal fold.
Chemung group. *Mansfield, Pa.*

Grammysia circularis.

Page 361.

See Plate 57.

Fig. 13. The left side of a large individual. The specimen was found in the town of Nichols, Tioga Co., N. Y. Its precise horizon is unknown.

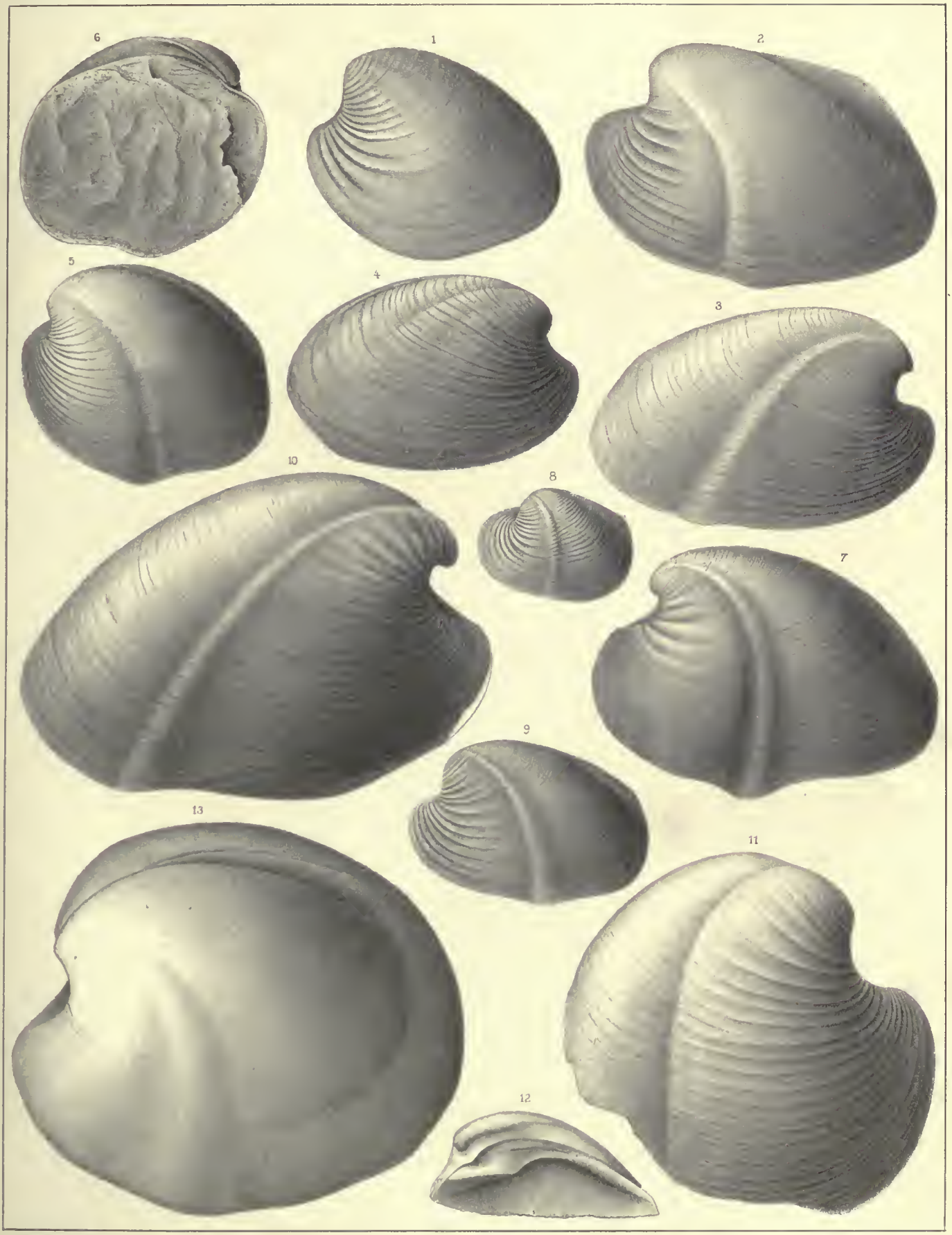
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PLATE LIX.

GRAMMYSIA PRÆCURSOR.

Page 376.

Fig. 1. The right side of a specimen preserving both valves.
Schoharie grit. *Schoharie, N. Y.*

GRAMMYSIA SECUNDA.

Page 376.

Figs. 2, 3. Cardinal view and right side of a specimen.
Corniferous limestone. *Clarence Hollow, N. Y.*

GRAMMYSIA CONSTRICTA ?

Page 377.

See Plate 78.

Figs. 4, 5. Right and left sides of the same specimen, referred to this species with doubt.
From a compact limestone in the Marcellus shale. *Near Buffalo, N. Y.*

GRAMMYSIA LIRATA.

Page 371.

Fig. 6. Left side of a small specimen.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 7. A cardinal view of a specimen holding the two valves in conjunction.
Fig. 8. A larger individual.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 9. The left side of an individual retaining the two valves in conjunction.
Fig. 10. Cardinal view of a larger specimen.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 11. A right valve of another individual.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 12. A cardinal view of a specimen.
Hamilton group. *Schoharie Co., N. Y.*

PLATE LIX—Continued.

GRAMMYSIA CONSTRICTA.

Page 377.

See Plate 78.

Fig. 13. The right side of a small individual retaining the proper form of the shell.

Fig. 14. The right valve of another individual, the anterior end shortened by compression in an oblique direction.

Hamilton group. *Shore of Seneca lake, N. Y.*

Fig. 15. A left valve, the anterior end shortened by compression.

Fig. 16. A right valve retaining the normal form.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 17. A small left valve somewhat shortened anteriorly by compression, the surface preserving a few of the radiating striæ, enlarged to two diameters.

Hamilton group. *Ludlowville, N. Y.*

Fig. 18. A cardinal view of a specimen of ordinary dimensions.

Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 19. The right side of a specimen retaining both valves, the anterior end greatly shortened by compression, the surface preserving the radiating striæ, enlarged to two diameters.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 20. An enlargement of the surface showing the pustulose character, from the specimen fig. 15

GRAMMYSIA OBSOLETA.

Page 366.

Figs. 21–23. Left side, anterior and cardinal views of a specimen which is vertically compressed.

Hamilton group. *Cazenovia, N. Y.*

Fig. 24. The interior of a left valve showing the cardinal area and elevation of the umbo.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 25. A specimen retaining the two valves in conjunction, each one of which is somewhat narrowed by compression.

Fig. 26. A left valve preserving nearly the normal proportions.

Hamilton group. *Pratt's falls, N. Y.*

Fig. 27. A left valve of a specimen somewhat compressed and showing the characteristic fold and sinus upon the anterior end of the valve.

Hamilton group. *Schoharie Co., N. Y.*

(GRAMMYSIIDÆ.)

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Plate LIX.

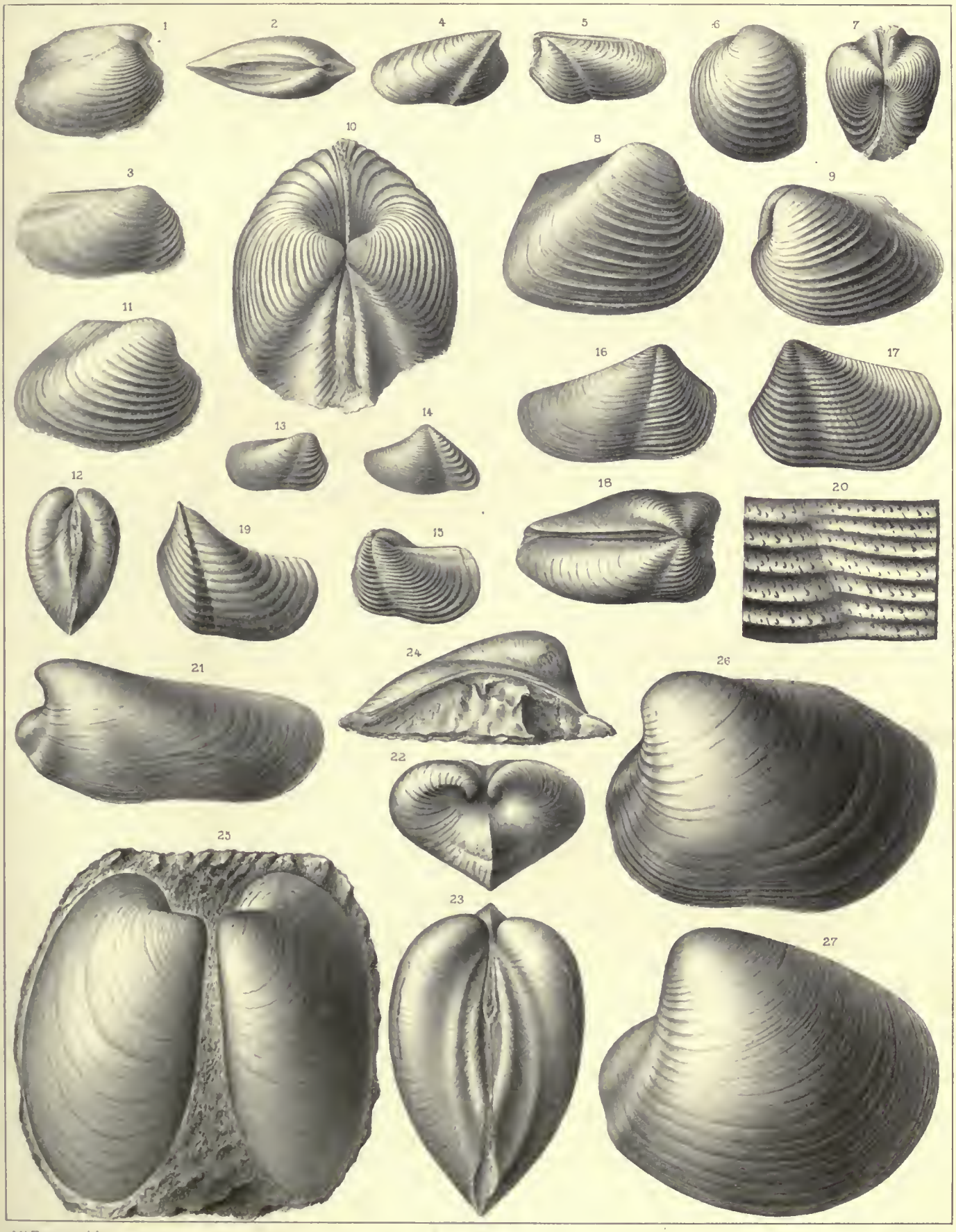

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PLATE LX.

GRAMMYSIA ALVEATA.

Page 370.

See Plate 57.

Fig. 1. The left side of a specimen retaining both valves.
Hamilton group. *Madison Co., N. Y.*

Figs. 2–4. Left side, anterior and cardinal views of a specimen retaining its natural proportions.
Hamilton group. *Scholarie Co., N. Y.*

Fig. 5. Cardinal view of a specimen which is vertically compressed.

Fig. 6. The right side of a specimen preserving nearly the normal form.
Hamilton group. *Madison Co., N. Y.*

Fig. 7. The cardinal area of a left valve.
Hamilton group. *Otsego Co., N. Y.*

Fig. 8. A left valve preserving the normal form.
Hamilton group. *Madison Co., N. Y.*

Figs. 9, 10. Left side and anterior end of a large individual with sharp and distinct concentric folds.
Hamilton group. *Scholarie Co., N. Y.*

Fig. 11. The left side of a compressed specimen fig. 1 of plate 57.

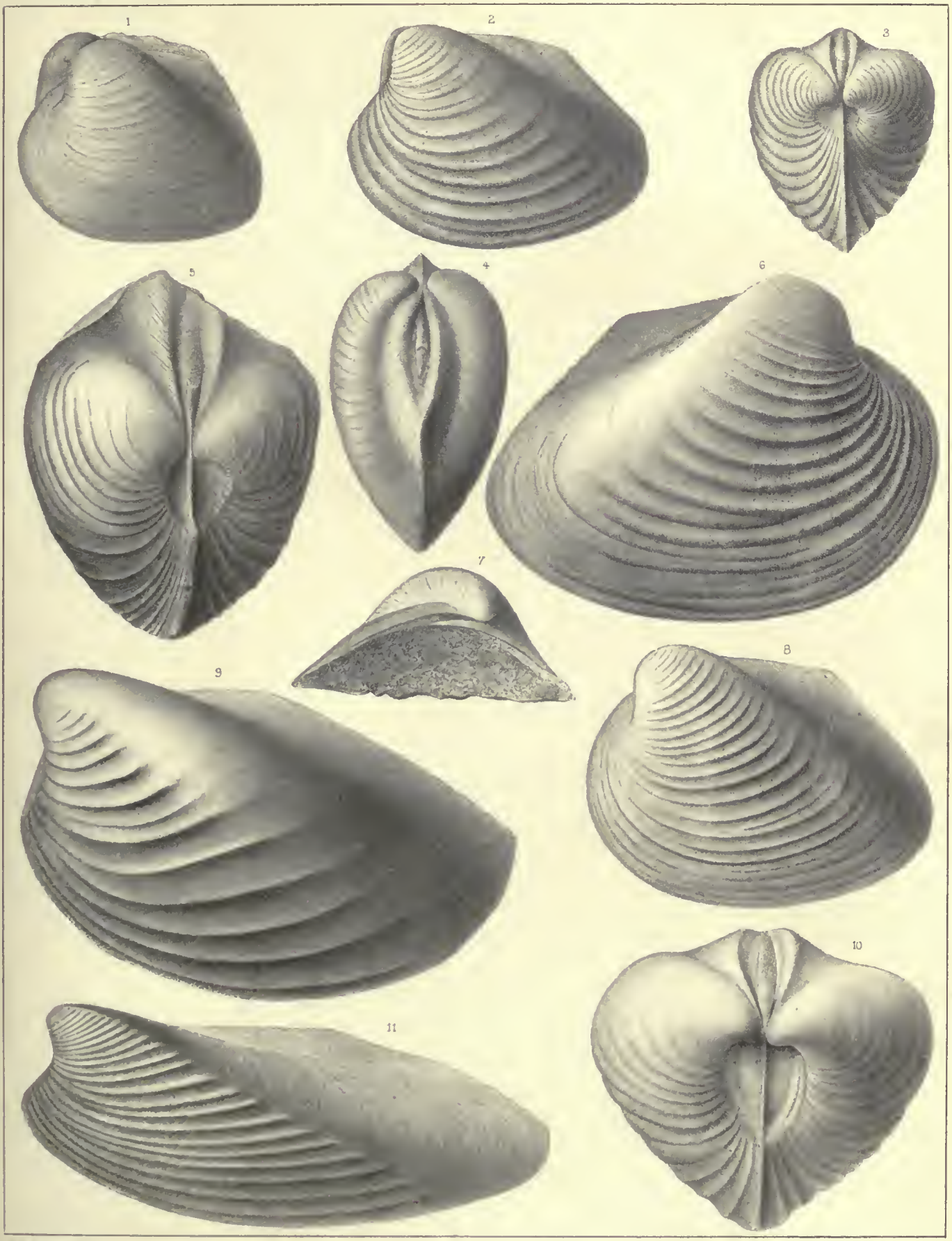
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PLATE LXI.

Grammysia arcuata.

Page 373.

See Plates 63, 93.

Figs. 1–5. A series of valves presenting the usual characters of the species.

Figs. 6, 7. Left side and anterior views of a specimen which is vertically compressed.

Fig. 8. The right valve of a large individual.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 9. Cardinal view of a specimen vertically compressed, giving an extreme angularity to the umbonal slope.

Hamilton group. *Shore of Canandaigua lake. N. Y.*

Grammysia subarcuata.

Page 375.

See Plate 93.

Figs. 10–12. A series of left valves of the usual character.

Figs. 13–15. Larger individuals of the same species.

Figs. 16, 17. The left side and cardinal view of a compressed specimen.

Chemung group. *Near Elmira, N. Y.*

Fig. 18. A cardinal view of a compressed specimen.

Lower Chemung group. *Ithaca, N. Y.*

Fig. 19. A cardinal view of a crushed specimen.

Lower Chemung group. *Ithaca, N. Y.*

Fig. 20. A cardinal view of a crushed specimen.

Fig. 21. The right side of a vertically compressed specimen.

Chemung group. *Near Elmira, N. Y.*

Fig. 22. An enlargement of the surface striæ on the post-cardinal slope of the specimen fig. 19.

Grammysia undata.

Page 379.

See Plates 64, 93.

Fig. 23. A small left valve.

Chemung group. *Near Panama, N. Y.*

PLATE LXI—Continued.

GRAMMYSIA COMMUNIS.

Page 378.

See Plate 93.

Fig. 24. A right valve.
Chemung group. *Near Hobbieville, N. Y.*

Fig. 25. A left valve proportionally broader than the preceding.
Chemung group. *Near Hobbieville, N. Y.*

Fig. 26. A left valve of elongate form.

Fig. 27. A left valve of a smaller specimen.
Chemung group. *Cattaraugus Co., N. Y.*

Fig. 28. A large left valve.
Chemung group. *Cattaraugus Co., N. Y.*

GRAMMYSIA HANNIBALENSIS.

Page 381.

Fig. 29. A right valve.

Fig. 30. The left side of a specimen.
Waverly group. *Cuyahoga Co., Ohio.*

Fig. 33. A right valve.
Choteau limestone. *Hannibal, Mo.*

GRAMMYSIA PLENA.

Page 382.

Fig. 31. A left valve.
Yellow sandstone. *Burlington, Iowa.*

Fig. 32. A left valve of shorter form, showing the characteristic plication on the post-cardinal slope.
Yellow sandstone. *Burlington, Iowa.*

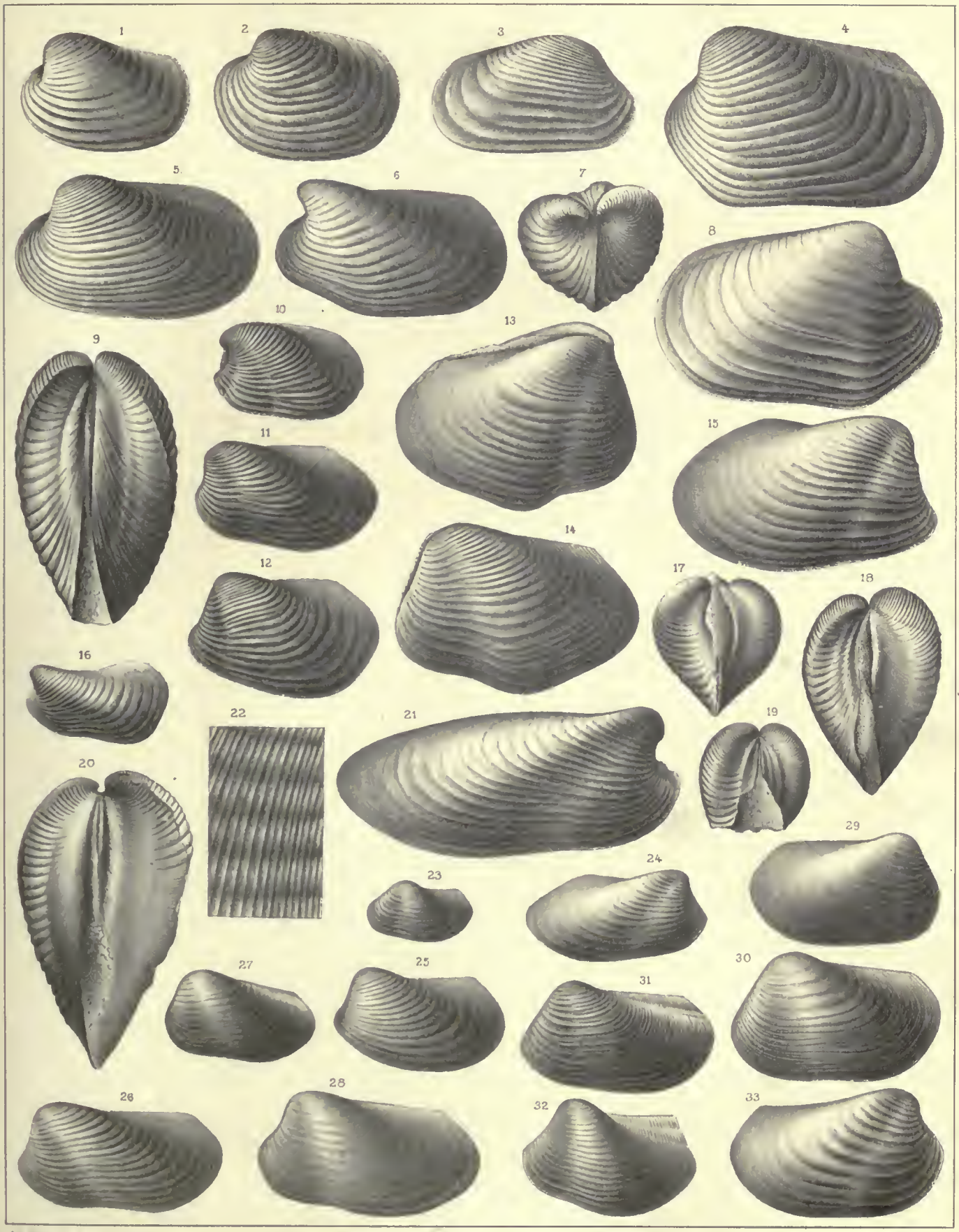
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PLATE LXII.

Grammysia (Sphenomya) cuneata.

Page 383.

See Plate 93.

Fig. 1. A small right valve.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 2. A cardinal view of a small individual.
Hamilton group. *Near Apulia, N. Y.*

Fig. 3. The right valve of a large individual somewhat vertically compressed.
Hamilton group. *New Berlin, N. Y.*

Fig. 4. The left side of a crushed specimen.

Fig. 5. The right side of the same showing the short hinge line.

Fig. 6. The right side of a compressed specimen.

Fig. 7. The right side of a specimen similar to the preceding.

Fig. 8. A cardinal view of a specimen from a gutta-percha impression in the natural mould.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 9. Cardinal view of a large individual which has been vertically crushed.
Hamilton group. *Otsego Co., N. Y.*

Grammysia globosa.

Page 372.

Fig. 10. The right side of a small individual.
Hamilton group. *Leonardsville, N. Y.*

Figs. 11, 12. Left side and cardinal view of a specimen somewhat compressed.
Hamilton group. *Hamilton, N. Y.*

Fig. 13. Anterior view of the specimen fig. 10.

Fig. 14. Anterior view of the specimen fig. 11.

Fig. 15. Anterior view of a specimen with the valves conjoined along the hinge and separated below.
Hamilton group. *Hamilton, N. Y.*

Fig. 16. A view of the right valve of the preceding specimen.

Fig. 17. A cardinal view of the same specimen.

Fig. 18. The right side of a specimen preserving both valves.

Fig. 19. The left side of the same specimen, the valve distorted by pressure.
Hamilton group. *Near Hamilton, N. Y.*

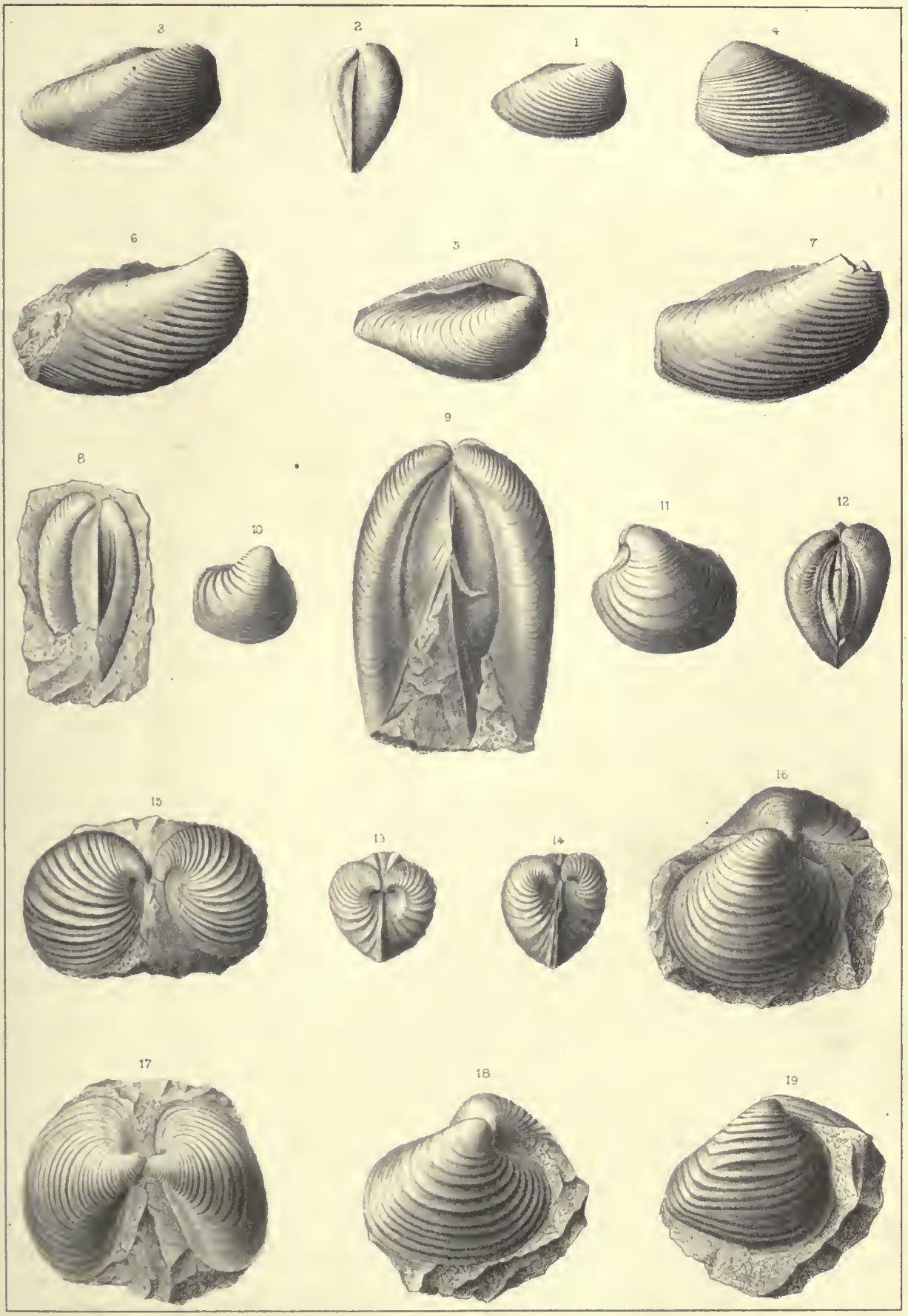
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PLATE LXIII.

Grammysia bellatula.

Page 367.

Fig. 1. A small block of shale preserving two valves, probably of the same individual.
Hamilton group. *York Center, Livingston Co., N. Y.*

Figs. 2, 3. The two valves enlarged.

Grammysia zonata.

Page 373.

Fig. 4. A left valve, enlarged.
Hamilton group. *Schoharie Co., N. Y.*

Fig 5. A specimen retaining both valves in conjunction. In the left valve the ridge on the umbonal slope is due to a fracture and exaggerated in the figure

Grammysia arcuata ?

Page 373.

See Plates 61, 93.

Fig. 6. The left valve of a cast of the interior. The ridge on the umbonal slope is probably due to a fracture in the shell.
Hamilton group. *Eighteen Mile creek, N. Y.*

Grammysia Ertopia.

Page 368.

Fig. 7. A right valve. The umbo is represented as too narrow in the figure, and the apparent furrow on the post-cardinal slope is a gentle fold.
Hamilton group. *Shore of Seneca lake, N. Y.*

Fig. 8 A large right valve.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Edmondia ? tenuistriata.

Page 393.

See Plate 95.

Fig. 9. An imperfect right valve.
Chemung group. *Near Elmira, N. Y.*

Fig. 10. An enlargement of the surface showing the concentric lines of growth and radiating striæ.

PLATE LXIII—Continued.

EUTHYDESMA SUBTEXTILE.

Page 385.

See Plate 93.

Figs. 11–13. Left valves of this species.
Portage group. *Lake Erie shore, Chautauqua Co., N. Y.*

Fig. 14. A right valve.

Fig. 15. An enlargement of the surface, incorrectly represented.

Fig. 16. A left valve of an old individual presenting strong oblique folds on the middle of the shell.
Portage group. *Lake Erie shore, Chautauqua Co., N. Y.*

SCHIZODUS DEGENER.

Page 456.

Fig. 17. A left valve. The umbo and beak are too much elevated in the figure.

PARACYCLAS ROTUNDA.

Page 444.

See Plate 95.

Fig. 18. A right valve.
Chemung group. *Broome Co., N. Y.*

Fig. 19. A left valve.
Chemung group. *Broome Co., N. Y.*

SCHIZODUS PATULUS.

Page 457.

Fig. 20. A left valve.
Chemung group. *Near Mansfield, Pa.*

PALÆOMYA OBLONGA.

Page 509.

Fig. 21. A cast of the interior of a left valve showing muscular imprints and strong concentric undulations of growth.
Hamilton group. *Schoharie Co., N. Y.*

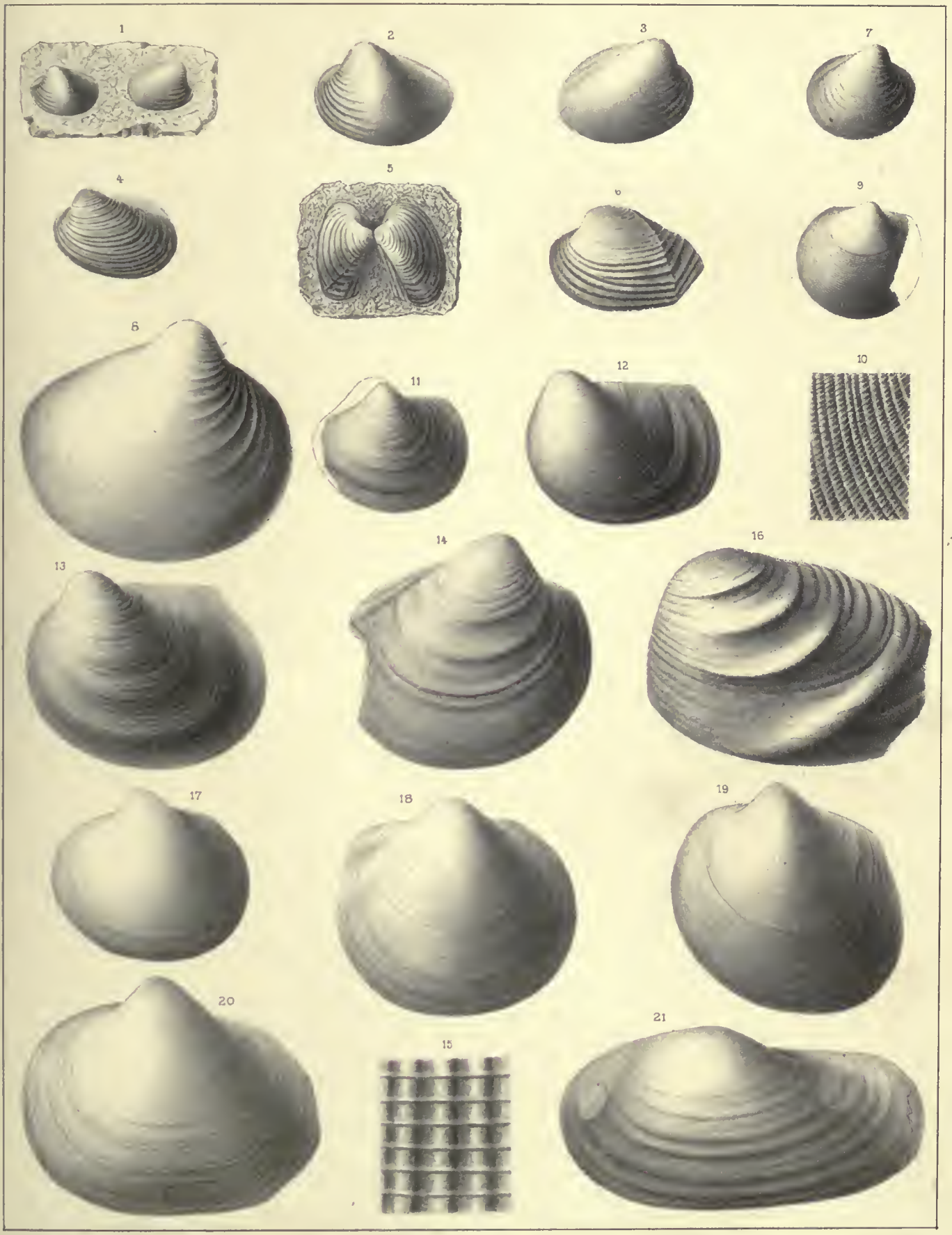
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PLATE LXIV.

SANGUINOLITES (?) UNDULATUS.

Page 508.

Figs. 1, 2. Right and left valves presenting some differences.
Chemung group. *Cattaraugus Co., N. Y.*

SANGUINOLITES (?) SUBTRUNCATUS.

Page 508.

Fig. 3. A left valve.
Chemung group. *Cherry creek, Chautauqua Co., N. Y.*

Fig. 4. A right valve. The anterior end as represented is too broad.
Chemung group. *Connewango, Cattaraugus Co., N. Y.*

GRAMMYSIA ? SUBNASUTA.

Page 507.

Figs. 5, 6. Left valves.
Chemung group. *Near Olean, N. Y.*

EDMONDIA RHOMBOIDEA.

Page 386.
See Plates 75, 95.

Fig. 7. A left valve.
Chemung group. *Near Salamanca, N. Y.*

Fig. 8. A right valve.
Chemung group. *North of Panama, N. Y.*

EDMONDIA PHILIPI.

Page 387.
See Plate 95.

Fig. 9. A left valve of short and broad form.
Chemung group. *Hobbieville, N. Y.*

Fig. 11. A left valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 12. A left valve.
Chemung group. *Connewango, N. Y.*

Fig. 13. A left valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 14. A right valve.
Chemung group. *Philipsburgh, N. Y.*

Fig. 17. A left valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 29. A young individual.
Chemung group. *Philipsburgh, N. Y.*

EDMONDIA SUBOVATA.

Page 389.
See Plate 95.

Fig. 10. A left valve doubtfully referred to this species.
Chemung group. *Philipsburgh, N. Y.*

Fig. 18. A left valve preserving the characteristic form.
Chemung group. *Hobbieville, N. Y.*

Figs. 19, 20. Two right valves.
Chemung group. *Philipsburgh, N. Y.*

Fig. 21. A right valve of more elongate form than usual, and referred with doubt to this species.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 26. A large right valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 27. A right valve of medium size.
Chemung group. *Philipsburgh, N. Y.*

Fig. 28. A right valve of a large individual.
Chemung group. *Philipsburgh, N. Y.*

EDMONDIA OBLIQUA.

Page 388.
See Plate 95.

Fig. 15. A left valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 16. A right valve referred with doubt to this species.
Chemung group. *Philipsburgh, N. Y.*

Fig. 23. A right valve of this species.
Chemung group. *Philipsburgh, N. Y.*

EDMONDIA BURLINGTONENSIS.

Page 390.
See Plate 95.

Fig. 22. A right valve. The beak and umbo are represented as too much elevated.
Yellow sandstone. *Burlington, Iowa.*

EDMONDIA TRANSVERSA.

Page 389.

Fig. 24. A left valve.
Chemung group. *Cattaraugus Co., N. Y.*

EDMONDIA ELLIPSIS.

Page 392.

Fig. 25. A left valve. The beak is represented as too angular and elevated.
Burlington sandstone. *Burlington, Iowa.*

GRAMMYSIA UNDATA.

Page 379.
See Plates 61, 93.

Fig. 30. A left valve.
Chemung group. *Portville, N. Y.*

EDMONDIA ? SUBCARINATA.

Fig. 31. The right valve of an imperfect specimen.
Chemung group. *Near Olean, N. Y.*

EDMONDIA DEPRESSA.

Page 391.

Fig. 32. A right valve.
Waverly sandstone. *Licking Co., Ohio.*

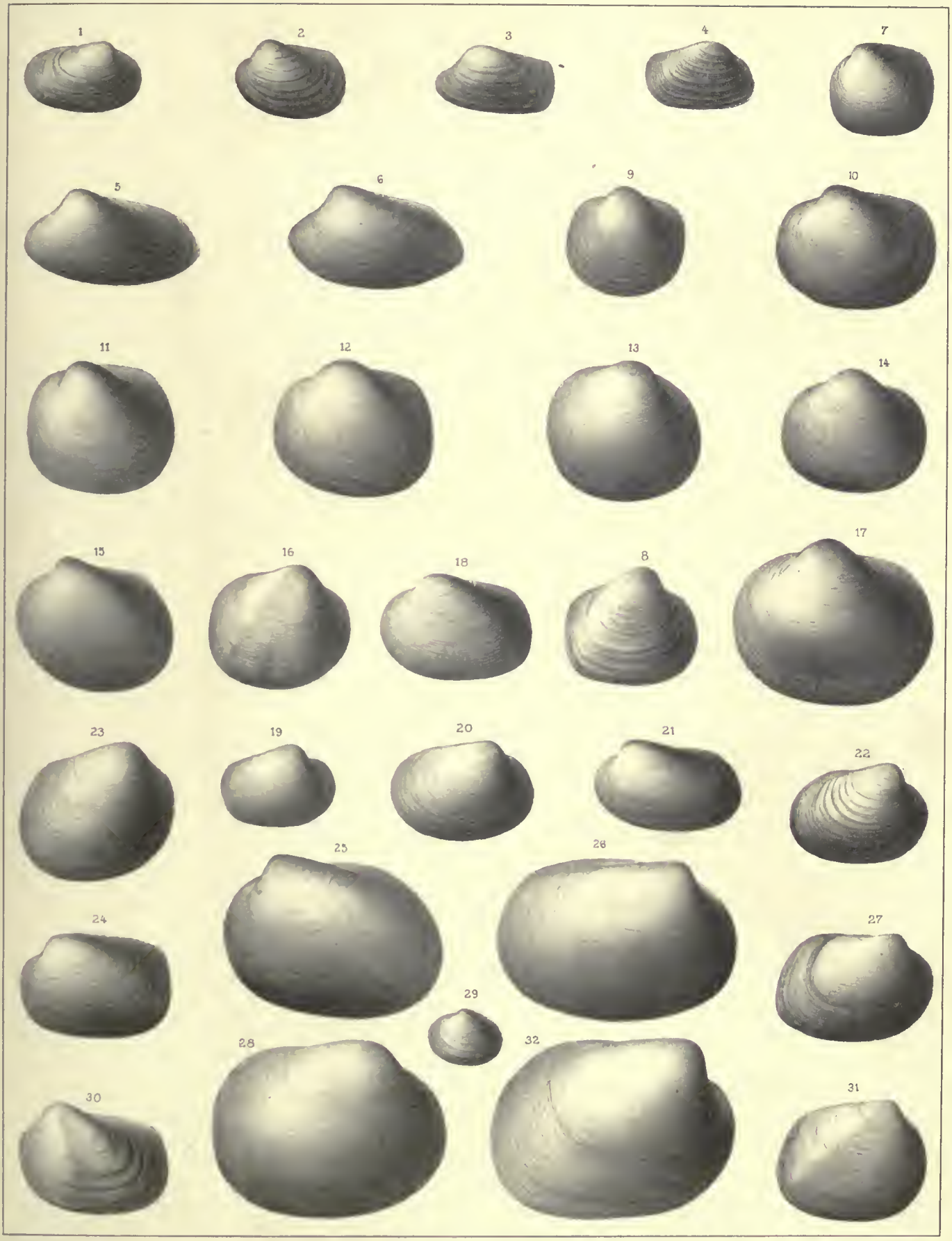
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PLATE LXV.

SPHENOTUS TRUNCATUS.

Page 394.

Fig. 1. A small right valve.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 4. A specimen preserving both valves.
Hamilton group. *Schoharie Co , N. Y.*

Fig. 5. A smaller individual enlarged to two diameters.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 6. A left valve showing unusually strong concentric undulations.
Hamilton group. *Schoharie Co., N. Y.*

ORTHONOTA ? PARVULA.

Page 482.

See Plate 78.

Figs. 2, 3. Left and right valves. The fold on the post-cardinal slope is too strongly represented.

SPHENOTUS ARCÆFORMIS.

Page 395.

See Plate 66.

Figs. 7–10. Four right valves showing some variation in form and proportions.
Fig. 11. A left valve.
Hamilton group. *Delphi, N. Y.*

SPHENOTUS CUNEATUS.

Page 396.

Figs. 12–14. Three valves presenting the usual characters of this species.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 15. The right side of a small specimen retaining the valves in conjunction.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 16. A large right valve.
Hamilton group. *Schoharie Co , N. Y.*

Fig. 17. A large specimen with the valves conjoined.
Hamilton group. *Schoharie Co., N. Y.*

PLATE LXV—Continued.

SPHENOTUS SUBTORTUOSUS.

Page 397.

Fig. 18. A left valve.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 19. A somewhat smaller left valve.
Hamilton group. *York, Livingston Co., N. Y.*

GONIOPHORA IDA.

Page 300.
See Plate 42.

Fig. 20. A specimen preserving both valves.
Hamilton group. *Genesee, Livingston Co., N. Y.*

SPHENOTUS SOLENOIDES.

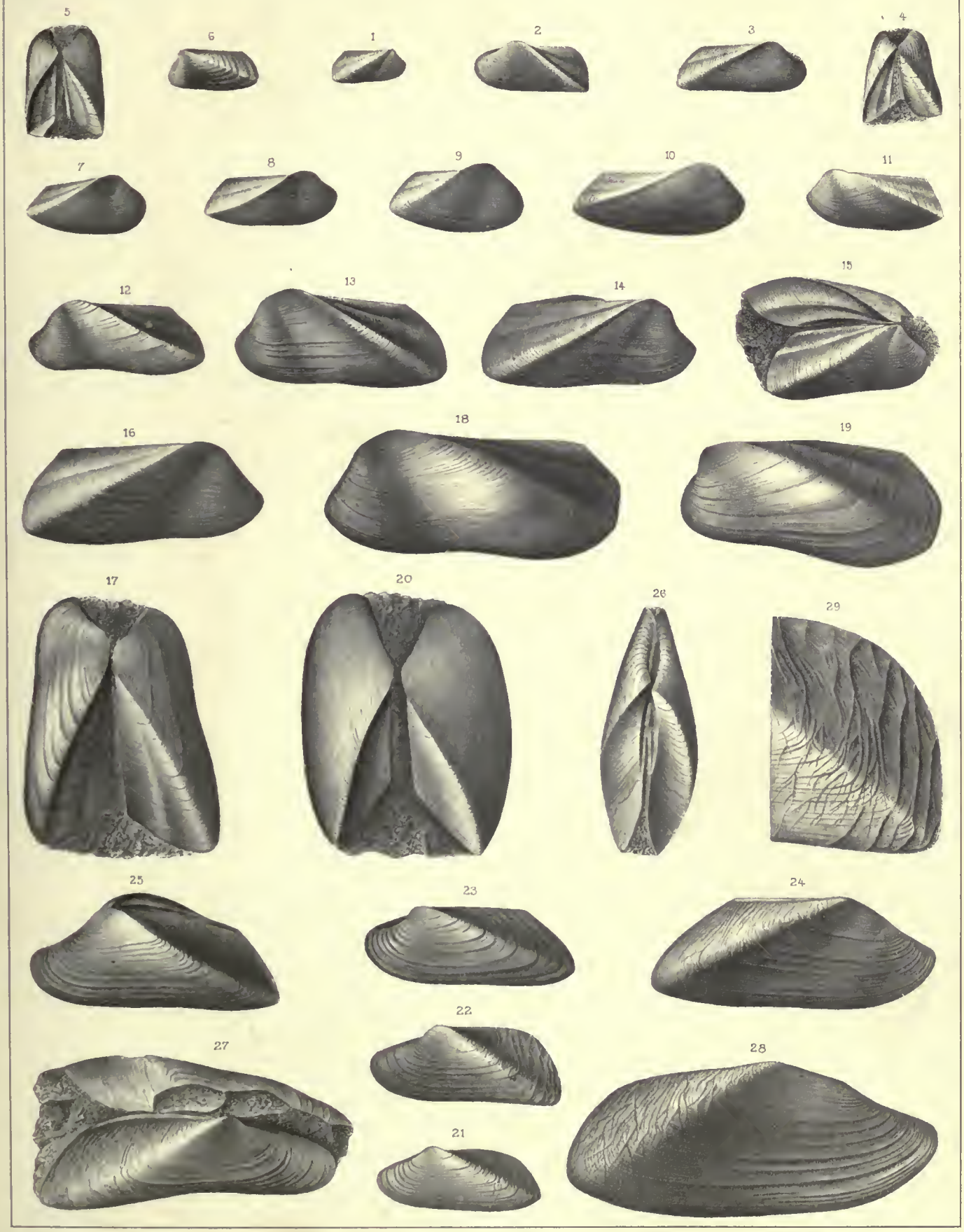
Page 398.

Figs. 21–23. Three small left valves.
Fig. 24. A right valve of medium size.
Figs. 25, 26. Left side and cardinal views of a specimen which is somewhat compressed vertically.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Fig. 27. The right side of a specimen preserving both valves.
Hamilton group. *Bellona, N. Y.*
Fig. 28. A large right valve.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Fig. 29. An enlargement of the posterior portion of the specimen fig. 22 showing the vascular-like markings.

HAMILTON GROUP.

(SANGUINOLITIDÆ.)

Palæontology N.Y. Vol. V. Plate LXV.



G.B. Simpson. del.

PLATE LXVI.

SPHENOTUS CONTRACTUS.

Page 399.

See Plate 94.

Fig. 1. A left valve preserving the shell in part, and showing the anterior muscular impression.
Chemung group. *Philipsburgh, N. Y.*

Figs. 3, 4. Larger left valves.
Chemung group. *Philipsburgh, N. Y.*

Fig. 5. A smaller left valve imperfect at the posterior extremity.
Chemung group. *Eight miles south of Mayville, N. Y.*

Fig. 6. A small right valve somewhat compressed vertically, giving a narrow cardinal slope.
Chemung group. *Philipsburgh, N. Y.*

Figs. 7–9. Right valves of specimens showing gradation in size and the muscular scars.
Chemung group. *Alleghany Co., N. Y.*

Fig. 10. A right valve showing a wide post-cardinal slope and a rounded posterior extremity, in which it differs from the others.
Chemung group. *Rockville, N. Y.*

Fig. 11. The inner side of the right valve fig. 6 enlarged, showing the ligamental area and a narrow groove beneath the umbo.

Fig. 12. A right valve showing anterior muscular impression.
Chemung group. *Near Olean, N. Y.*

Fig. 13. A left valve of elongate form.
Chemung group. *Near Olean, N. Y.*

Fig. 15. A large left valve imperfect at the anterior end.
Chemung group. *Cattaraugus Co., N. Y.*

Figs. 16, 17. Shorter forms which are referred to this species with doubt.
Chemung group. *Cattaraugus Co., N. Y.*

Fig. 19. A left valve doubtfully referred to this species.
Chemung group. *Cherry creek, Cattaraugus Co., N. Y.*

SPHENOTUS CLAVULUS.

Page 401.

Fig. 2. A small left valve.
Chemung group. *Philipsburgh, N. Y.*

Figs. 20–26. A series of valves showing the variety of size and form.

SPHENOTUS RIGIDUS.

Page 402.

Fig. 14. The right side of the original specimen.
Burlington sandstone. *Burlington, Iowa.*

PLATE LXVI—Continued.

SPHENOTUS? ARCUATUS.

Page 400.

Fig. 18. A cast of a right valve, showing the anterior muscular impression and preserving the remains of striæ of growth.
Chemung group. *Near Panama, N. Y.*

SPHENOTUS FLAVIUS.

Page 403.

Figs. 27–29. Left, right and cardinal views of a specimen which has been somewhat compressed vertically.
Waverly group. *Licking Co., Ohio.*

SPHENOTUS VALVULUS.

Page 403.

Fig. 30. A right valve.
Waverly group. *Newark, Ohio.*

SPHENOTUS ÆOLUS.

Page 404.

Figs. 31–34. A series of right and left valves showing some variety of form and aspect.
Waverly group. *Ohio.*

Fig. 35. A cardinal view of the specimen fig. 33, showing the long ligamental area.
Waverly group. *Licking Co., Ohio.*

SPATHELLA TYPICA.

Page 407.

Figs. 36–40. Left and right valves showing variation in form and proportions.
Chemung group. *Tompkins and Chemung Co's. N. Y.*

SPATHELLA VENTRICOSA.

Page 408.

Figs. 41, 42. Two left valves.
Burlington sandstone. *Burlington, Iowa.*

SPHENOTUS ARCÆFORMIS.

Page 395.

See Plates 65, 76.

Fig. 43. A left valve, referred with doubt to this species.
Chemung group. *Near Smethport, Pa.*

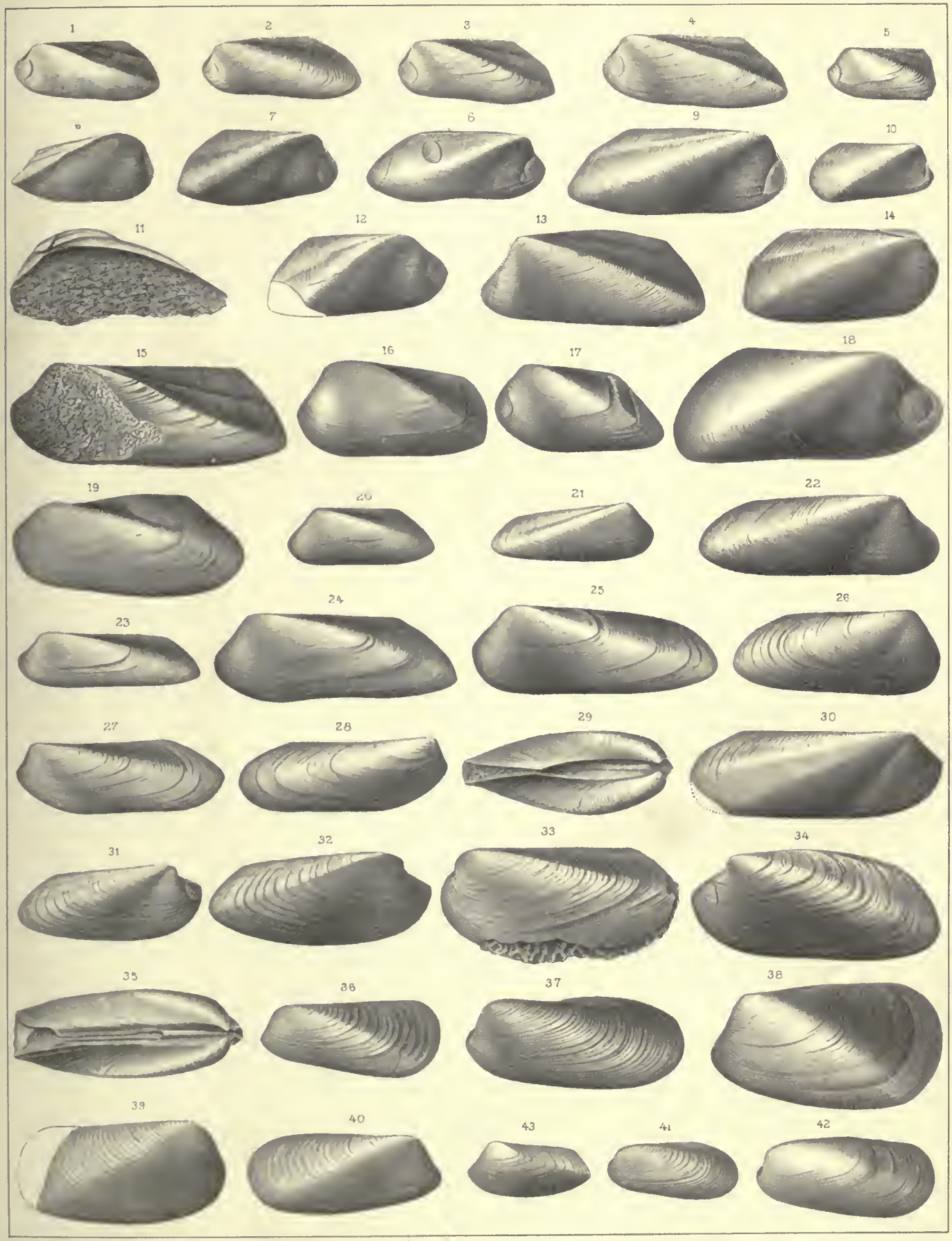

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PLATE LXVII.

CONOCARDIUM CUNEUS, var. ATTENUATUM.

Page 410.

Fig. 1. A small right valve.
Schoharie grit. *Knox, Albany Co., N. Y.*

Fig. 2. A cast of a small right valve.
Schoharie grit. *Knox, Albany Co., N. Y.*

Fig. 3. A ventral view of the cast of the interior of a small specimen.
Schoharie grit. *Schoharie, N. Y.*

Fig. 4. Cardinal view of a small individual, retaining portions of the test.
Schoharie grit. *Schoharie, N. Y.*

Figs. 5, 6. The right valves of two specimens showing simple radii.
Schoharie grit. *Schoharie, N. Y.*

Figs. 7, 8. Left and right sides of a cast of the interior.
Schoharie grit. *Schoharie, N. Y.*

Fig. 9. The posterior end of a specimen retaining both valves.

Fig. 10. An enlargement of the surface from the specimen fig. 5.

Fig. 11. A ventral view of a small cast of an interior, showing the furrows left by the thickened margins of the shell.
Schoharie grit. *Schoharie, N. Y.*

CONOCARDIUM CUNEUS, var. NASUTUM.

Page 410.

Figs. 12, 13. Ventral and left sides of a small specimen.
Schoharie grit. *Schoharie, N. Y.*

Figs. 14, 15. Left side and ventral view of a specimen retaining its natural form and showing a duplication of the radii.
Schoharie grit. *Schoharie, N. Y.*

Fig. 16. A ventral view of a specimen retaining a portion of the test.

Fig. 17. The right side of a small specimen.
Schoharie grit. *Schoharie, N. Y.*

Figs. 18–20. The cardinal, left and posterior views of a large individual retaining its normal form and proportions.
Schoharie grit. *Schoharie, N. Y.*

PLATE LXVII—Continued.

CONOCARDIUM CUNEUS.

Page 409.

See Plates 68, 94.

Fig. 21. The right side of a crushed specimen.

Fig. 22. An enlargement of the surface from the preceding.

Schoharie grit. *Schoharie, N. Y.*

Fig. 23. An imperfect partial cast of a left valve, showing the absence of radii on the surface of the test, and the strong radii on the interior of the shell

Schoharie grit. *Knox, Albany Co., N. Y.*

Figs. 24–26. Ventral views of three specimens, showing the duplication of the radii towards the margin, and the extension of the shell beyond the umbonal ridge.

Schoharie grit. *Albany Co., N. Y.*

Fig. 27. The posterior view of a specimen showing the expansion of the shell around the periphery of the umbonal ridge.

Fig. 29. The ventral side of a specimen from which the shell is exfoliated.

Schoharie grit. *Schoharie, N. Y.*

Figs. 30, 31. The left sides of two casts of the interior.

Schoharie grit. *Schoharie, N. Y.*

Fig. 32. The ventral view of a specimen.

Schoharie grit. *Albany Co., N. Y.*

CONOCARDIUM CUNEUS, var. TRIGONALE.

Page 410.

See Plates 68, 94.

Fig. 28. Ventral view of the original specimen, which is a partial cast of the interior, retaining portions of the test along the margins.

Corniferous limestone. *Canada West.*

UPPER HELDERBERG GROUP.

(CARDIIDÆ.)

Palæontology N.Y. Vol V.

Plate LXVII.

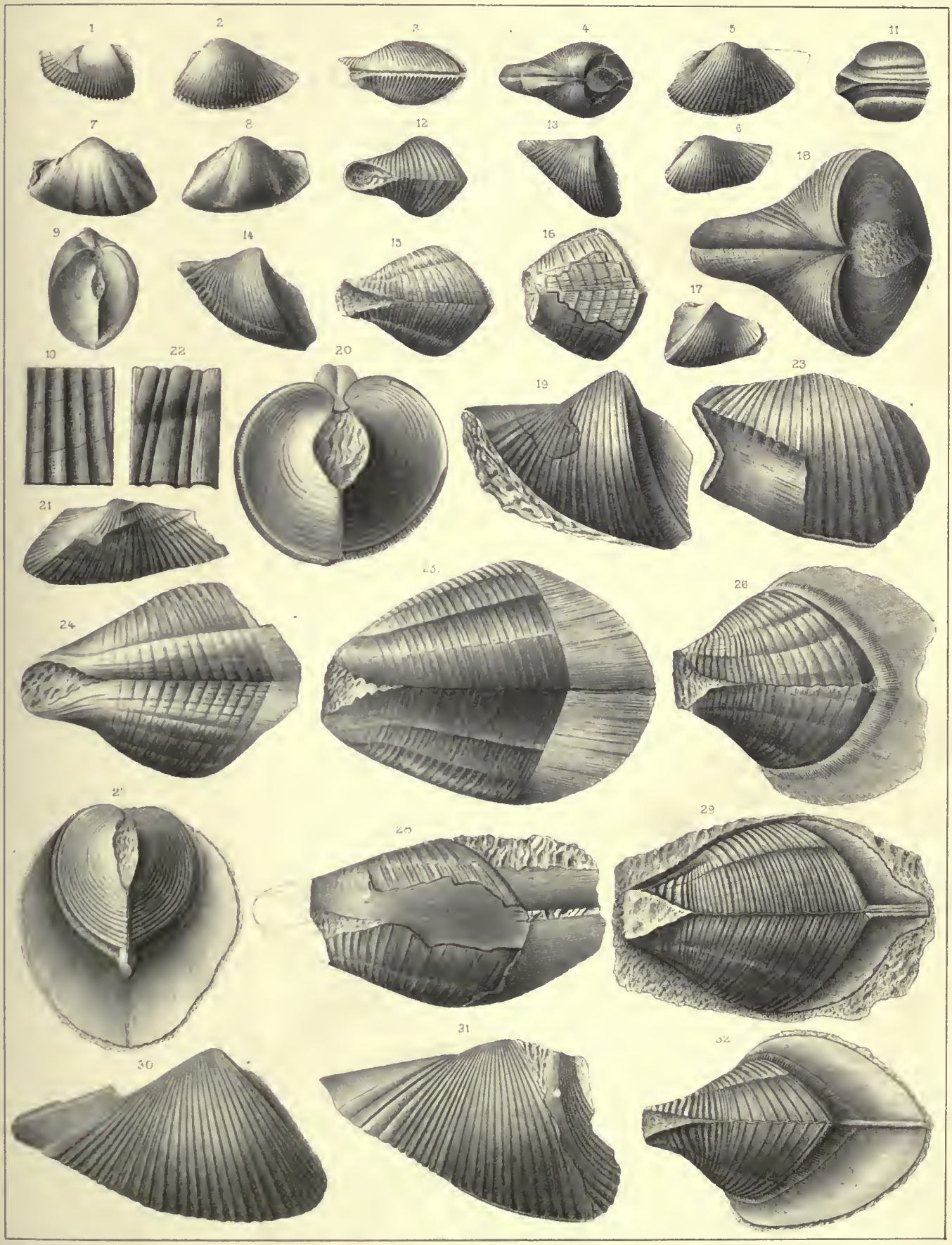

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PLATE LXVIII.

Conocardium cuneus, var. trigonale.

Page 410.

See Plates 67, 94.

Fig. 1. The ventral side of a small specimen.

Figs. 4–6. Ventral and cardinal views and right side of a small specimen retaining the shell.
Corniferous limestone. *Near Louisville, Ky.*

Fig. 7. An enlargement of the surface from the post-cardinal slope of the preceding.

Fig. 8. An enlargement showing a portion of three radii and the extension of the shell beyond the umbonal ridge, from the specimen fig. 6.

Fig. 9. Cardinal view of a specimen showing the surface markings.
Corniferous limestone. *Falls of the Ohio river.*

Figs. 10, 11. Left side and cardinal views of a specimen retaining portions of the test.
Corniferous limestone. *Near Louisville, Ky.*

Fig. 12. Ventral view of a specimen showing the pedal opening and denticulated margins.

Fig. 13. Cardinal view of a cast of the interior, showing anterior and posterior muscular scars.
Corniferous limestone. *Columbus, Ohio.*

Fig. 14. The right side of a specimen, preserving portions of the test and showing the extent of the umbonal expansion of the shell.

Fig. 16. Posterior view of the specimen fig. 12.

Conocardium Ohioense.

Pag 411.

Fig. 2. The left side of a specimen.
Corniferous limestone. *Near Louisville, Ky.*

Fig. 3. The left side of a nearly entire individual, enlarged to two diameters.
Corniferous limestone. *Falls of the Ohio river.*

Conocardium normale.

Page 411.

Figs. 17, 18. The right side and cardinal views of a large partial cast of the exterior of a specimen.
Hamilton group. *Cumberland, Md.*

Fig. 19. The right side of a cast of a smaller specimen, showing the anterior muscular scar and the filling of the foot sheath.
Hamilton group. *Cumberland, Md.*

Conocardium Eboraceum.

Page 412.

Figs. 20, 21. Ventral and cardinal views of a compressed specimen.
Hamilton group. *York, Livingston Co., N. Y.*

Figs. 22, 23. Ventral view and left side of a small specimen retaining the test and surface ornamentation, enlarged to two diameters.
Hamilton group. *York, N. Y.*

PLATE LXVIII—Continued.

CONOCARDIUM DENTICULATUM.

Page 413.

Figs. 24, 25. Left side and ventral views of an imperfect specimen, enlarged to three diameters. Fig. 25 represents the denticulations of the margins as too slender, and interlocking more than in the specimen.

Hamilton group. *York, N. Y.*

CONOCARDIUM CONCINNUM.

Page 414.

Fig. 26. Posterior view of a specimen.

Hamilton group. *Pratt's falls, N. Y.*

Fig. 27. Ventral view of another individual.

CONOCARDIUM LIRATUM.

Page 414.

Fig. 28. A right valve as obtained from a gutta-percha impression of a natural mould, enlarged to three diameters.

Lower Chemung group. *Ithaca. N. Y.*

Fig. 29. Anterior view of a specimen enlarged to three diameters.

Lower Chemung group. *Ithaca, N. Y.*

CONOCARDIUM TEGULUM.

Page 415.

Fig. 30. A fragment of an individual of this species.

Fig. 31. An enlargement of the surface of the preceding.

Niagara group.

CONOCARDIUM INCEPTUM.

Page 415.

Fig. 32. Ventral view of a specimen, enlarged to two diameters.

Lower Helderberg group. *Albany Co., N. Y.*

CONOCARDIUM RELIQUUM.

Page 415.

Fig. 33. A view of the posterior end of a specimen as obtained from a gutta-percha impression.

Chemung group.

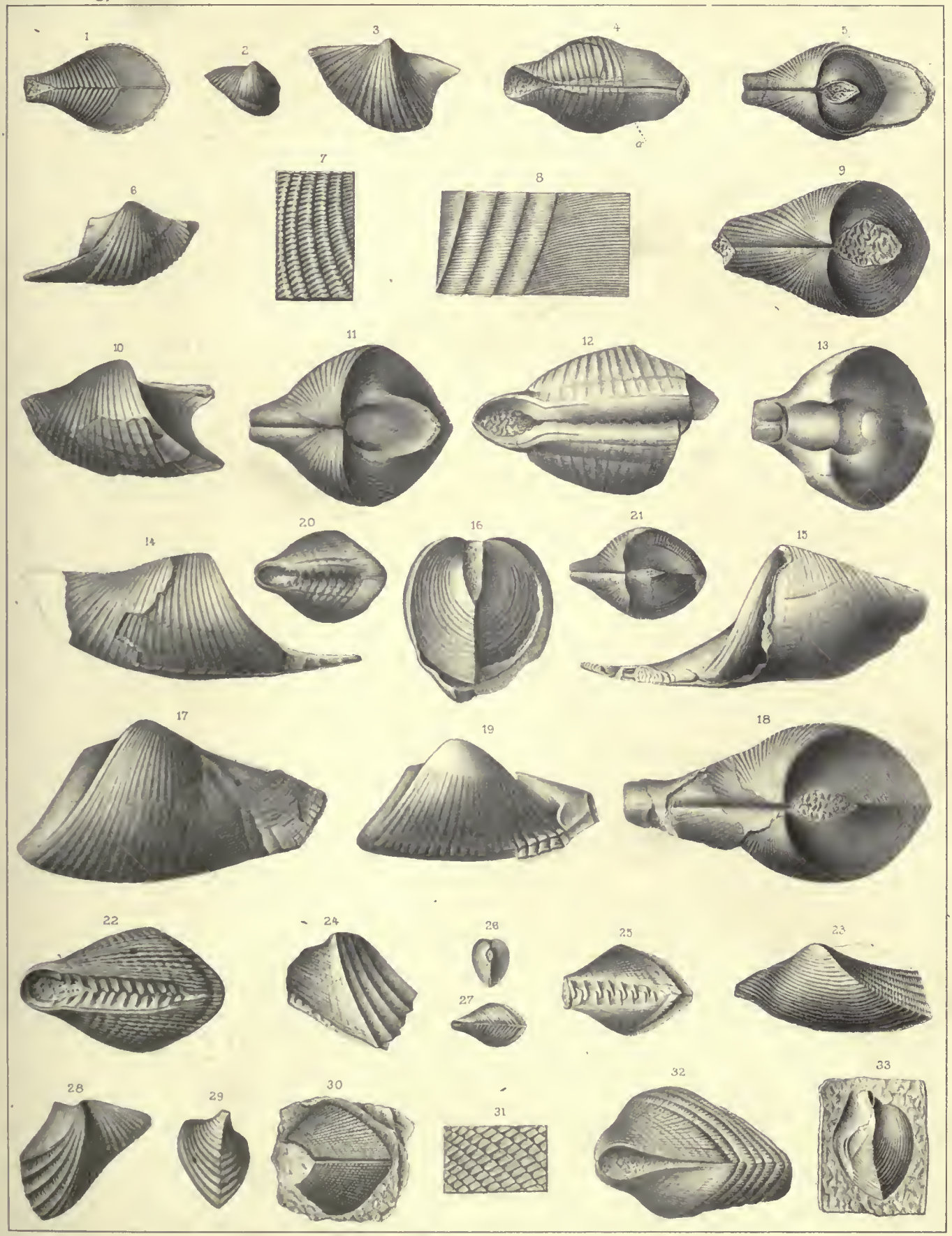
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PLATE LXIX.

PANENKA VENTRICOSA.

Page 417.

Fig. 1. The left valve of a specimen. The beak is represented as too obtuse in the figure.

Fig. 2. Cardinal view of the preceding, showing the triangular area under the beak.

Goniatite limestone. *Schoharie, N. Y.*

PANENKA HERO.

Page 418.

Fig. 3. A left valve. The beak is not sufficiently elevated in the figure.

Marcellus shale. *Indian reservation, Erie Co., N. Y.*

PANENKA EQUILATERA.

Page 419.

See Plate 94.

Fig. 4. A right valve.

Marcellus shale. *Littleville, N. Y.*

Fig. 7. Cardinal view of a left valve, doubtfully referred to this species.

Hamilton group. *Cumberland, Md.*

PANENKA MULTIRADIATA.

Page 417.

See Plate 94.

Fig. 5. The right side of the specimen described. See fig. 18, plate 94, for a correct drawing of the same.

Corniferous limestone. *Clarence Hollow, Erie Co., N. Y.*

PANENKA RETUSA.

Page 421.

Fig. 6. Left valve. The radii are represented as too close together.

Hamilton group. *Shore of Cayuga lake, N. Y.*

PLATE LXIX—Continued.

PANENKA POTENS.

Page 422.

Fig. 8. Right side of a specimen showing the form and surface characters.
Hamilton group. *Madison Co., N. Y.*

Fig. 10. The left side of a specimen retaining both valves in conjunction. The right valve is erroneously represented as having a broad ligamental area.
Hamilton group. *Madison Co., N. Y.*

PANENKA RADIANS.

Page 422.

Fig. 9. Left side of a specimen retaining both valves.
Hamilton group. *Cazenovia, N. Y.*

PANENKA ABRUPTA.

Page 423.

See Plate 94.

Fig. 11. Cardinal view of a cast of the interior.
Hamilton group. *Cumberland, Md.*

PANENKA LINCKLÆNI.

Page 420.

Fig. 12. A right valve of ordinary size.
Marcellus shale. *Ontario Co., N. Y.*

Fig. 13. A somewhat larger right valve of this species.
Marcellus shale. *Mission House, four miles south of Buffalo, N. Y.*

Fig. 14. An unusually large left valve.
Marcellus shale. *Mission House, four miles south of Buffalo, N. Y.*

UPPER HELDERBERG & HAMILTON GROUPS.

(CARDIIDÆ.)

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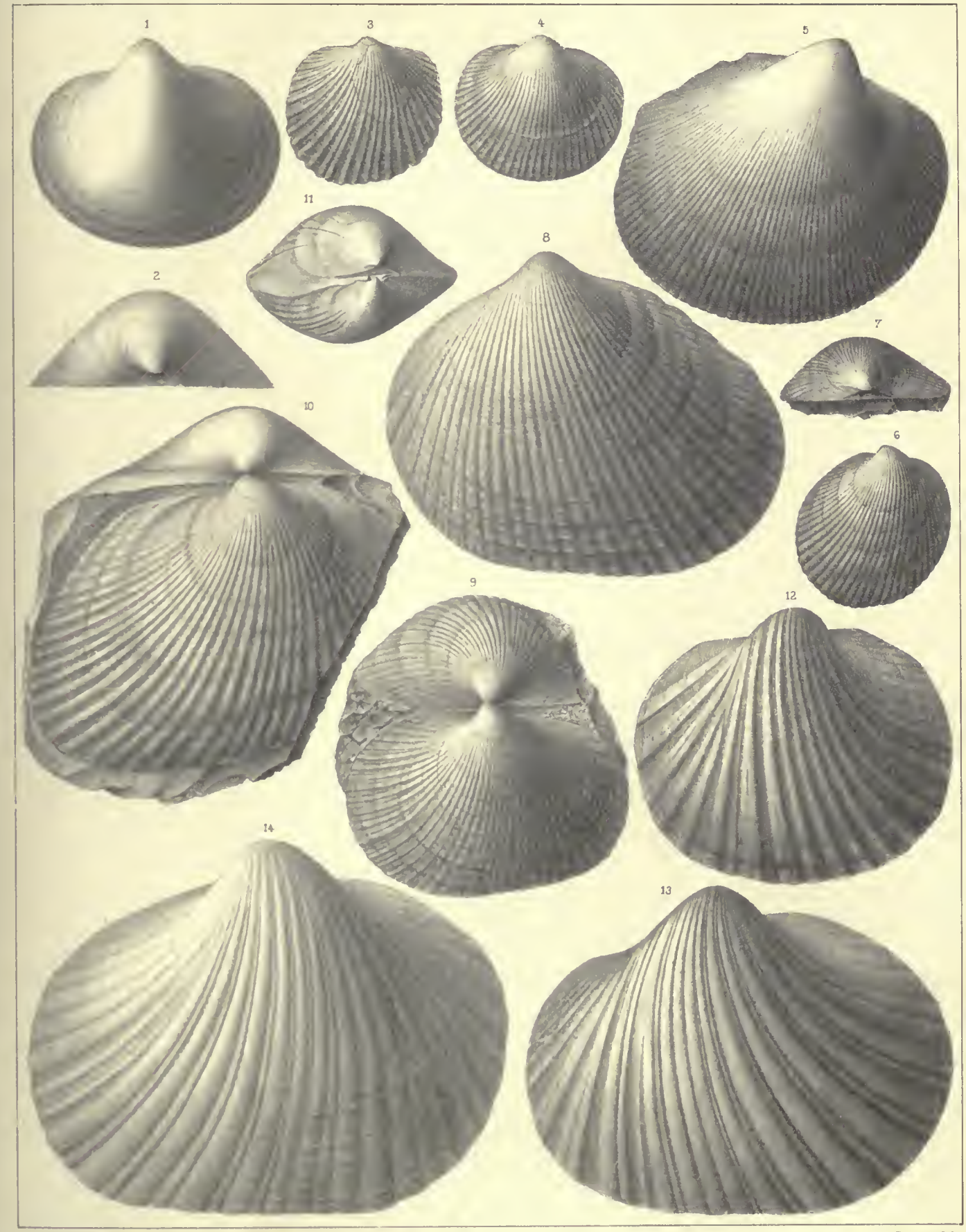
Plate LXIX.



J. H. Emerton del.

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PLATE LXX.

CARDIOLA FLUCTUANS, Barr.

Fig. 1. Cardinal view of the right valve, showing the triangular area under the beak. This species is introduced for comparison with American allied forms. See plate 94, fig. 23.
Silurian. *Bohemia.*

GLYPTOCARDIA SPECIOSA.

Page 426.

See Plate 80.

Figs. 2, 3. Views of two specimens retaining both valves in conjunction, enlarged to four diameters.
Genesee slate. *Bristol Centre, N. Y.*

Fig. 4. A right valve enlarged to four diameters.
Genesee slate. *Ontario Co., N. Y.*

Fig. 5. An enlargement of a small left valve.

Figs. 6–8. Three valves showing strong surface ornaments.
Portage group. *Branchport, N. Y.*

Fig. 9. A right valve enlarged to three diameters, showing strong arching lamellose striæ on the radii.
Marcellus shale. *Skaneateles, N. Y.*

PARACARDIUM DORIS.

Page 428.

Figs. 10, 11. Two valves of this species enlarged to six diameters.
Portage group. *Cashaqua creek, N. Y.*

PARARCA TRANSVERSA.

Page 429.

Fig. 12. A left valve.
Chemung group. *Salamanca, N. Y.*

Figs. 14, 15. Two right valves.
Chemung group. *Salamanca, N. Y.*

PARARCA NEGLECTA.

Page 432.

Fig. 13. A left valve showing the form and surface characters.
Waverly group. *Meadville, Pa.*

PLATE LXX—Continued.

PARARCA ERECTA.

Page 432.

See Plate 94.

Fig. 16. A left valve.
Waverly group. *Meadville, Pa.*

PARARCA SAO.

Page 430.

Fig. 17. A right valve. The umbonal slope is more defined than represented in the figure.
Chemung group. *Meadville, Pa.*

PRÆCARDIUM VENUSTUM.

Page 427.

Figs. 18–20. Three valves showing the prevailing characters of the species.
Portage group. *Shore of Lake Erie, Chautauqua Co., N. Y.*

PANENKA DICHOTOMA.

Page 416.

See Plate 94.

Fig. 21. A large right valve.
Schoharie grit. *Schoharie, N. Y.*

PANENKA ROBUSTA.

Page 424.

Figs. 22–24. Two left valves and one right valve of this species, showing the characteristic form and surface ornamentation.
Portage group. *Below Portage, N. Y.*

CARDIOPSIS RADIATA.

Page 433.

Fig. 25. A right valve of this species.
Kinderhook group. *Rockford, Iowa.*

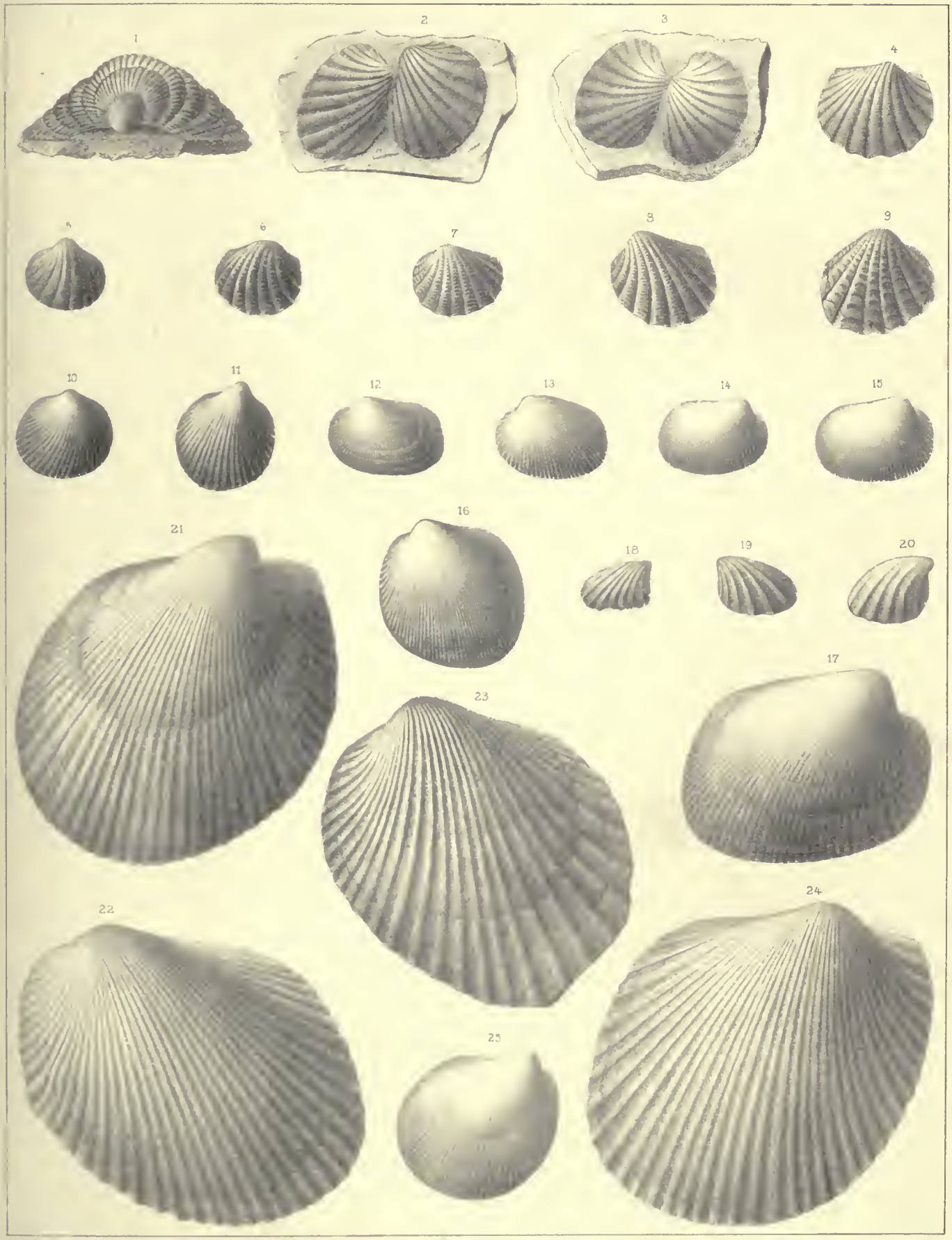
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PLATE LXXI.

Lunulicardium fragile.

Page 434.

Figs. 1–8. A series of valves representing the prevailing characters of this species, enlarged to two diameters.
Fig. 9. A specimen retaining both valves in conjunction, enlarged to four diameters.
Genesee slate. *Bristol Centre, N. Y.*
Fig. 10. A small right valve, enlarged to four diameters.
Fig. 11. A specimen retaining both valves.
Genesee slate. *Bristol Centre, N. Y.*
Fig. 12. A left valve showing the expansion of the shell along the posterior margin, enlarged to two diameters.
Genesee slate. *Indian reservation, Erie Co., N. Y.*
Fig. 13. A large left valve, enlarged to two diameters.
Genesee slate. *Penn Yan, Yates Co., N. Y.*
Fig. 14. The interior of two valves, enlarged to four diameters.
Genesee slate. *Penn Yan, N. Y.*

Lunulicardium Marcellense.

Page 435.

Figs. 15, 16. Two left valves retaining portions of the test.
Marcellus shale. *Cherry Valley, N. Y.*

Lunulicardium rude.

Page 435.

Fig. 17. A right valve, showing the form and surface characters.
Goniatite limestone. *Cherry Valley, N. Y.*

PLATE LXXI—Continued.

LUNULICARDIUM CURTUM.

Page 437.

Fig. 18. A left valve of this species.
Hamilton group. *Near Tully, N. Y.*

Fig. 19. An enlargement of the preceding to show more clearly its characteristic features.

Fig. 20. A right valve of somewhat different form.

Fig. 21. An enlargement of the same.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 22. A right valve of a somewhat broader form.
Marcellus shale. *Alden, Erie Co., N. Y.*

Fig. 23. An enlargement of the surface from the lower margin of the specimen fig. 18, showing its pustulose character.

LUNULICARDIUM ORBICULARE.

Page 436.

Fig. 24. A left valve.
Marcellus shale. *Bloomfield, N. Y.*

LUNULICARDIUM ORNATUM.

Page 437.

Figs. 25–27. Three valves showing the characteristic form of this species. The beak of fig. 26 is represented as too obtuse.
Chemung group. *Elmira, N. Y.*

Fig. 28. A left valve. The radii are more flattened than represented in the figure.
Portage group. *Cashaqua creek, N. Y.*

Fig. 29. An enlargement of the surface from the preceding.

Fig. 30. A left valve, laterally compressed, producing an elongate form. The specimen is the original of *Pinnopsis acutirostra.*
Portage group. *Cashaqua creek, N. Y.*

Fig. 31. A right valve similar to the preceding.
Chemung group. *Near Elmira, N. Y.*

Fig. 32. An enlargement from the surface of the specimen fig. 30. The summits of the rays are represented as too concave.

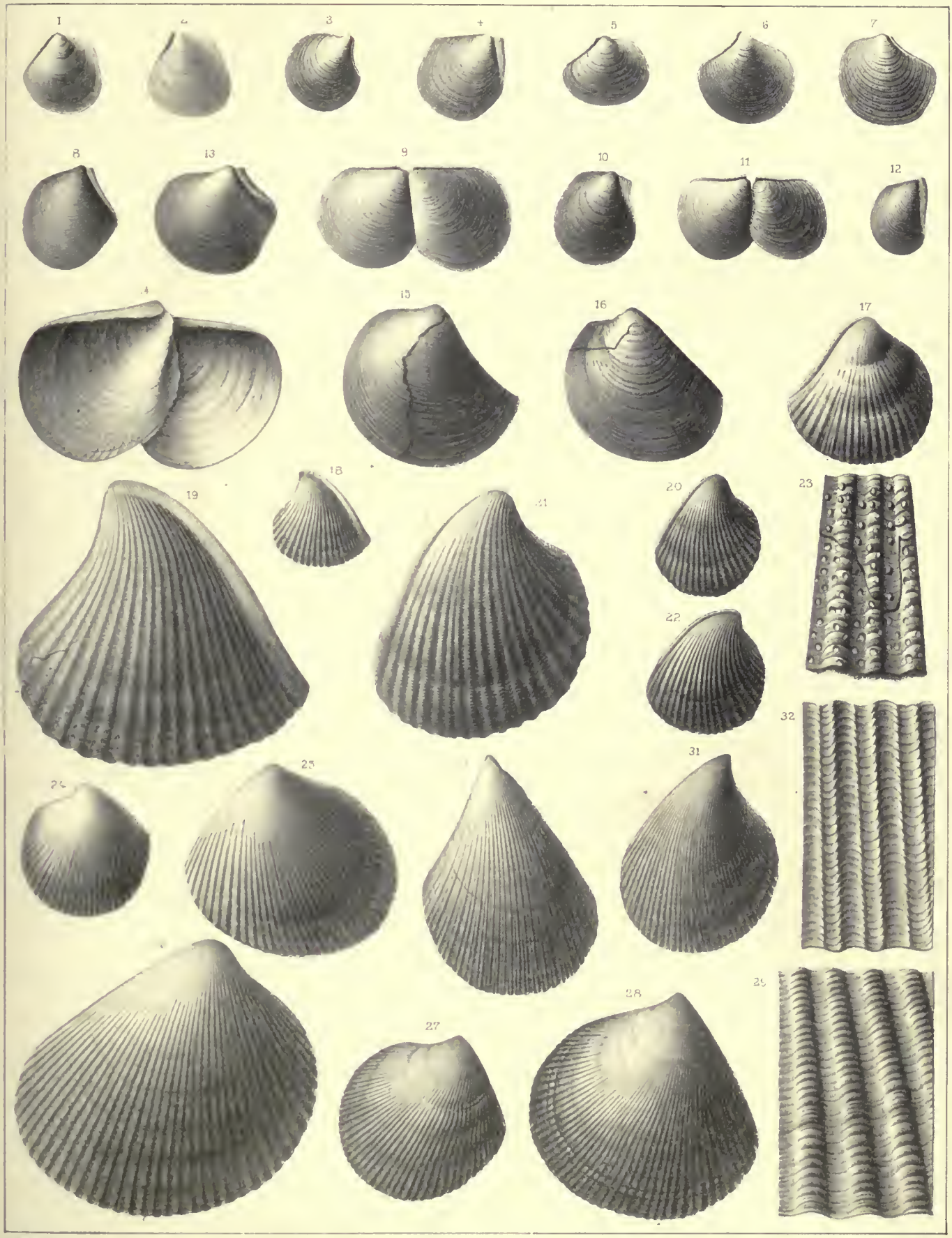
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PLATE LXXII.

Paracyclas Ohioensis.

Page 442.

See Plate 95.

Fig. 1. The right side of a specimen retaining the test.
Hamilton group. *Falls of the Ohio river.*

Paracyclas lirata.

Page 441

See Plate 95.

Figs. 2–5. A series of specimens illustrating the principal varieties of form and surface markings characteristic of the species, as found in the Cherty beds, above the Corniferous limestone belonging to the Hamilton group, at the falls of the Ohio river and in Clarke Co., Ind.

Figs. 6–19. A series illustrating the principal varieties as found in the Hamilton group in the State of New York. Figs. 9, 10 and 13 illustrate specimens distorted by pressure.

Paracyclas tenuis.

Page 443.

See Plate 95.

Figs. 20, 21. Two right valves enlarged to three diameters.
Hamilton group. *Bellona and shore of Cayuga lake, N. Y.*

Fig. 22. A large left valve enlarged to three diameters.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

PARACYCLAS ELLIPTICA.

Page 440.

See Plate 95.

Fig. 23. The left side of a specimen.
Corniferous limestone. *Clarence, N. Y.*

Fig. 24. The right side of a cast.
Corniferous limestone. *Columbus, Ohio.*

Figs. 25, 26. Left side and cardinal views of a specimen which is vertically compressed.
Corniferous limestone. *Leroy, N. Y.*

Figs. 27, 28. The right side and cardinal view of the cast of the interior, showing muscular scars, pallial line and ligamental grooves.
Corniferous limestone. *Cayuga, Ontario.*

Fig. 29. The left side of a large specimen.
Corniferous limestone. *Western New York.*

Fig. 30. The right side of a specimen, narrowed by compression.
Corniferous limestone. *Leroy, N. Y.*

Figs. 31–33. Left, right and cardinal views of an individual, retaining the shell and showing the surface characters.
Hamilton group. *Falls of the Ohio river.*

PARACYCLAS IGNOTA.

Page 444.

Fig. 34. A right valve of this species.
Chemung group. *Meadville, Pa.*

SCHIZODUS ? FISSA.

Page 447.

Figs. 35, 36. The right side and cardinal views of a cast of the interior.
Schoharie grit. *Schoharie, N. Y.*

Fig. 37. The right side of a compressed specimen.
Schoharie grit. *Schoharie, N. Y.*

Figs. 38–40. Right, left and cardinal views of a cast of the interior, showing muscular impressions.
Schoharie grit. *Schoharie, N. Y.*

Fig. 41. The right side of a cast showing anterior and posterior muscular scars.
Schoharie grit. *Schoharie, N. Y.*

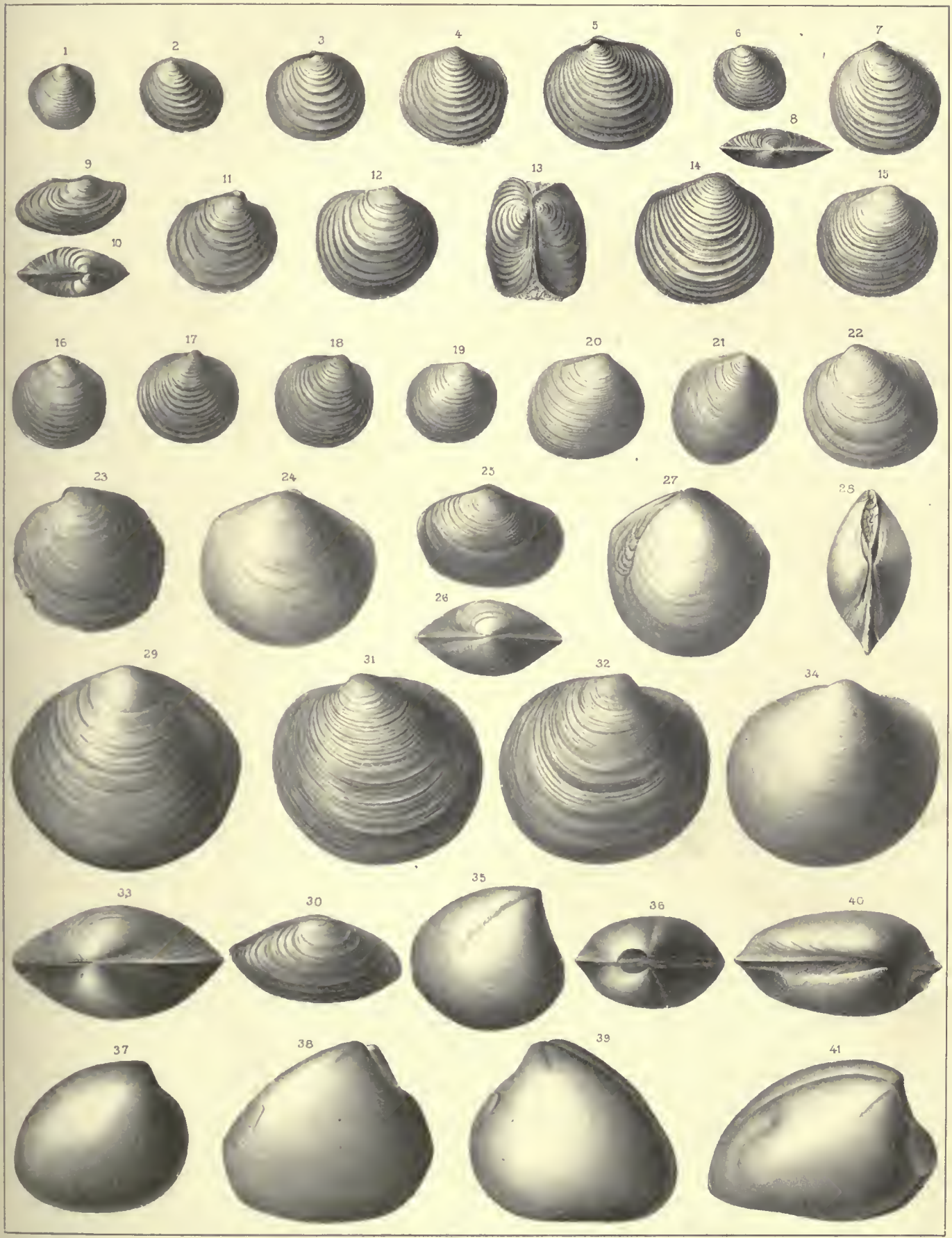
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PLATE LXXIII.

MICRODON (CYPRICARDELLA) GREGARIUS.

Page 309.

See Plate 74.

Figs. 1–6. Three right and three left valves showing the principal varieties of form and size.

MICRODON (CYPRICARDELLA) BELLISTRIATUS.

Page 308.

See Plates 42, 74.

Figs. 7–20. A series of specimens illustrating the principal varieties of form and surface characters.

Figs. 21, 22. The left and right sides of a specimen retaining both valves, showing the narrow form of the right valve, as produced by vertical compression.

Hamilton group. *N. Y.*

MICRODON (CYPRICARDELLA) TENUISTRIATUS.

Page 310.

See Plates 42, 74.

Figs. 23, 24. Two right valves.

Hamilton group. *Madison Co., N. Y.*

Fig. 25. A partial cast of a left valve, showing the anterior muscular scar and surface markings.

Hamilton group. *Madison Co., N. Y.*

Fig. 26. A specimen retaining both valves in conjunction.

Hamilton group. *Summit, Schoharie Co., N. Y.*

Figs. 27, 28. Right and left valves of elongate form.

Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 29. A left valve.

Hamilton group. *Madison Co., N. Y.*

Fig. 30. The interior of a left valve, as obtained from a gutta-percha impression, showing the hinge area, anterior muscular scar and pallial line.

Hamilton group. *Madison Co., N. Y.*

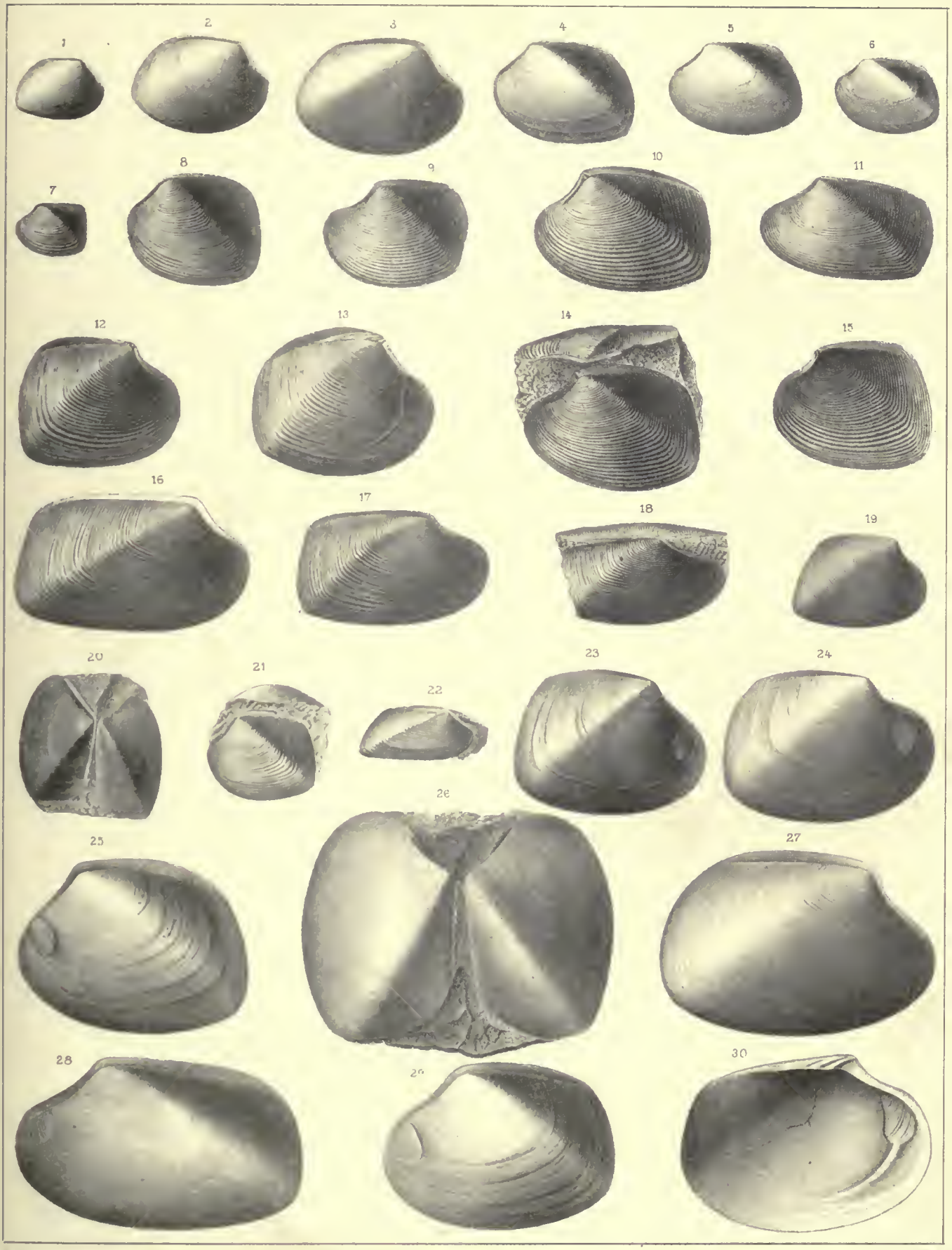
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PLATE LXXIV.

MICRODON (CYPRICARDELLA) GREGARIUS.

Page 309.

See Plate 73.

Figs. 1, 2. Right and left valves.
Chemung group. *Cortland, N. Y.*

Fig. 3. A left valve of more elongate form.

Fig. 4. A small left valve enlarged to two diameters. The striæ are represented as too regular and the beak too elevated.
Chemung group. *Near Elmira, N. Y.*

MICRODON (CYPRICARDELLA) BELLISTRIATUS.

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See Plates 42, 73.

Figs. 5, 6. Two right valves of elongate form.
Chemung group. *Near Elmira, N. Y,*

Figs. 7, 8. Right and left valves.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 9. The hinge of a left valve showing cardinal teeth and ligamental area, enlarged.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

Fig. 10. The hinge of a right valve, showing similar characters, enlarged.

MICRODON (CYPRICARDELLA) RESERVATUS.

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Figs. 11–13. Three valves showing the principal characters of this species.
Waverly group. *Licking Co., Ohio.*

MICRODON (CYPRICARDELLA) COMPLANATUS.

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See Plate 42.

Figs. 14–18. A series of valves showing the principal variations in size and form of this species.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 19. The interior of a right valve, as obtained from a gutta-percha impression in a natural mould, showing hinge characters, anterior muscular scars and pallial line.

MICRODON (CYPRICARDELLA) TENUISTRIATUS.

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See Plates 42, 73.

Figs. 21, 22. The hinges of a left and a right valve showing cardinal teeth and ligamental area, enlarged to two diameters.

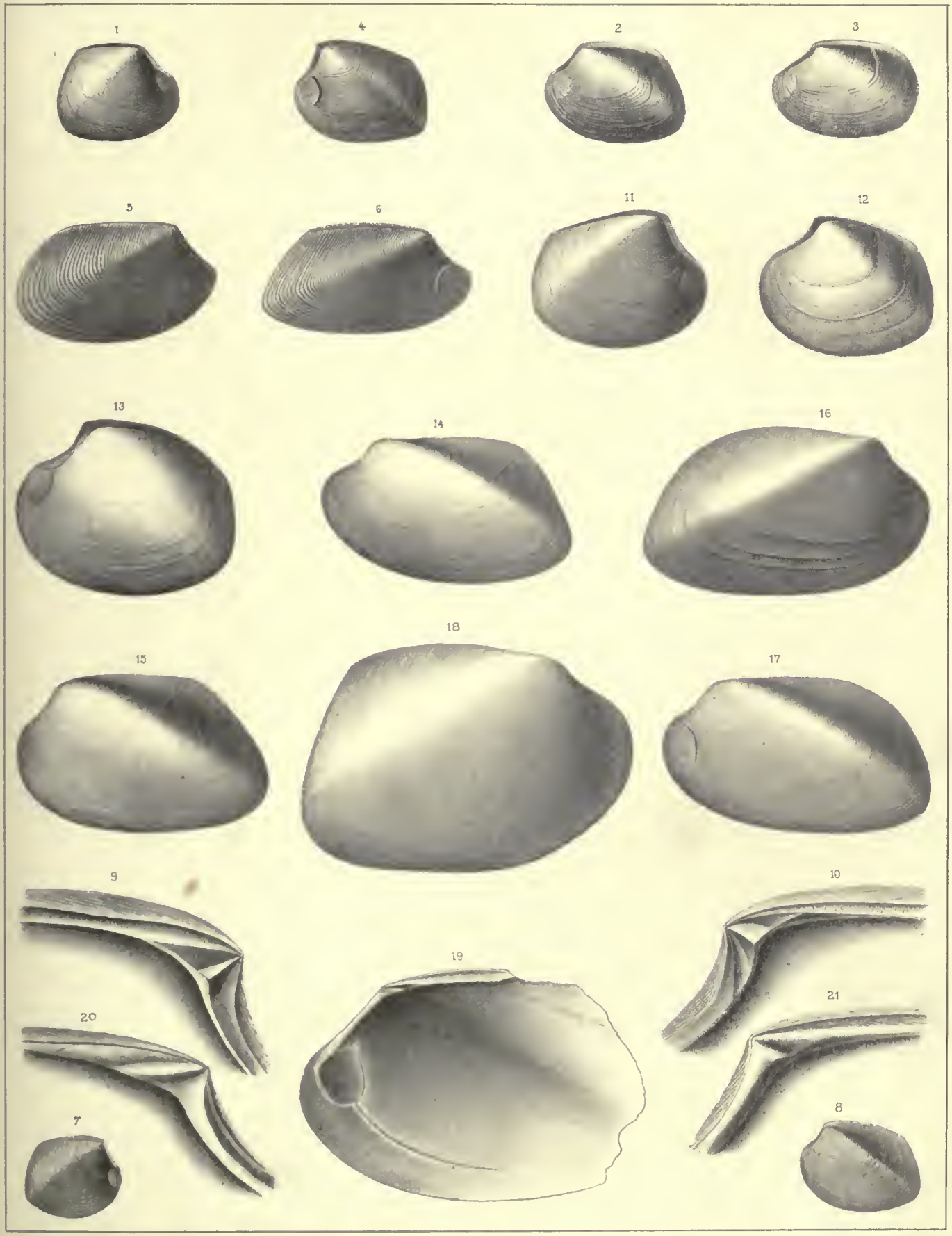
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PLATE LXXV.

SCHIZODUS TUMIDUS.

Page 448.

Figs. 1, 2. The right side and cardinal view of a cast of the interior, showing muscular scars and pallial line.
Corniferous limestone. *Columbus, Ohio.*

SCHIZODUS APPRESSUS.

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Fig. 3. A cast of an interior of a right valve, showing umbonal furrows, muscular scars and pallial line.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*
Fig. 4. A left valve of ordinary form.
Fig. 5. A specimen preserving both valves conjoined by the ligament.
Fig. 6. A left valve which is somewhat nasute at post-inferior extremity.
Hamilton group. *Shore of Cayuga lake, N. Y.*
Fig. 7. A right valve of elongate form.
Hamilton group. *Shore of Cayuga lake, N. Y.*
Fig. 8. A small right valve of rotund form.
Hamilton group. *Schoharie Co., N. Y.*
Fig. 9. A larger right valve.

CYTHERODON NASUTUS.

Page 511.

See Plate 95.

Fig. 10. The left side of the specimen described. See plate 95 for a correct drawing of this specimen.
Hamilton group. *Hardy Co., Va.*
Fig. 11. Cardinal view of the preceding, showing the impressions of the cardinal teeth.
Fig. 12. The interior of the cardinal portion of the same, as obtained from a gutta-percha impression.

SCHIZODUS ELLIPTICUS.

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Fig. 13. A right valve.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Figs. 14, 15. Two small left valves.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

SCHIZODUS GREGARIUS.

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See Plate 95.

Fig. 16. A left valve of this species.
Chemung group. *Near Tioga, Pa.*
Fig. 17. A portion of a block preserving the remains of several individuals.
Chemung group. *Near Tioga, Pa.*
Fig. 18. A right valve.
Chemung group. *Near Tioga, Pa.*

SCHIZODUS RHOMBEUS.

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Fig. 19. A left valve.
Chemung group. *Hobbieville, N. Y.*
Fig. 20. A left valve of somewhat different form.
Chemung group. *Chautauqua Co., N. Y.*
Figs. 21–23. A left valve and two right valves of this species.
Chemung group. *Cattaraugus Co., N. Y.*

PLATE LXXV—Continued.

PARACYCLAS ? PAUPER.

Page 446.

See Plate 95.

Fig. 24. A right valve, imperfectly represented.
Chemung group. *Alleghany Co., N. Y.*

Fig. 25. A small left valve. See fig. 20, plate 95, for a corrected drawing of this specimen.

Fig. 26. A large right valve.
Chemung group. *Near Olean, N. Y.*

SCHIZODUS CONTRACTUS.

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Figs. 27, 28. Two right valves enlarged to two diameters, showing the form and surface markings.
Hamilton group. *Shore of Cayuga lake, N. Y.*

SCHIZODUS CUNEUS.

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Fig. 29. A right valve of this species.
Waverly group. *Granville, Ohio.*

Fig. 30. A right valve referred to this species with doubt.
Waverly group. *Granville, Ohio.*

SCHIZODUS CHEMUNGENSIS, var. QUADRANGULARIS.

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Fig. 31. A cast of the interior of a small left valve, showing muscular scars and pallial line.
Lower Chemung group. *Ithaca, N. Y.*

Fig. 32. A partial cast of a larger right valve.

Fig. 33. A left valve of erect form.
Chemung group. *Near Elmira, N. Y.*

Fig. 34. A large right valve.
Chemung group. *Tioga Co., N. Y.*

Fig. 36. A left valve of medium size.
Chemung group. *Factoryville, Tioga Co., N. Y.*

SCHIZODUS ÆQUALIS.

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See Plate 95.

Fig. 35. The left side of an imperfect specimen preserving both valves.
Waverly group. *Licking Co., Ohio.*

SCHIZODUS CHEMUNGENSIS.

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Figs. 37–40. Two right and two left valves belonging to this species.

Fig. 41. An imperfect left valve referred to this species with doubt.

Fig. 45. A small left valve.
Chemung group. *Cortland, N. Y.*

EDMONDIA RHOMBOIDEA.

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See Plates 64, 95.

Fig. 42. A left valve. See plate 95, fig. 15, for a corrected drawing of this specimen.

SCHIZODUS OBLATUS.

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Fig. 43. A left valve.
Chemung group. *Napoli, Cattaraugus Co., N. Y.*

Fig. 44. The cast of interior of a right valve showing muscular scars.
Chemung group. *Napoli, Cattaraugus Co., N. Y.*

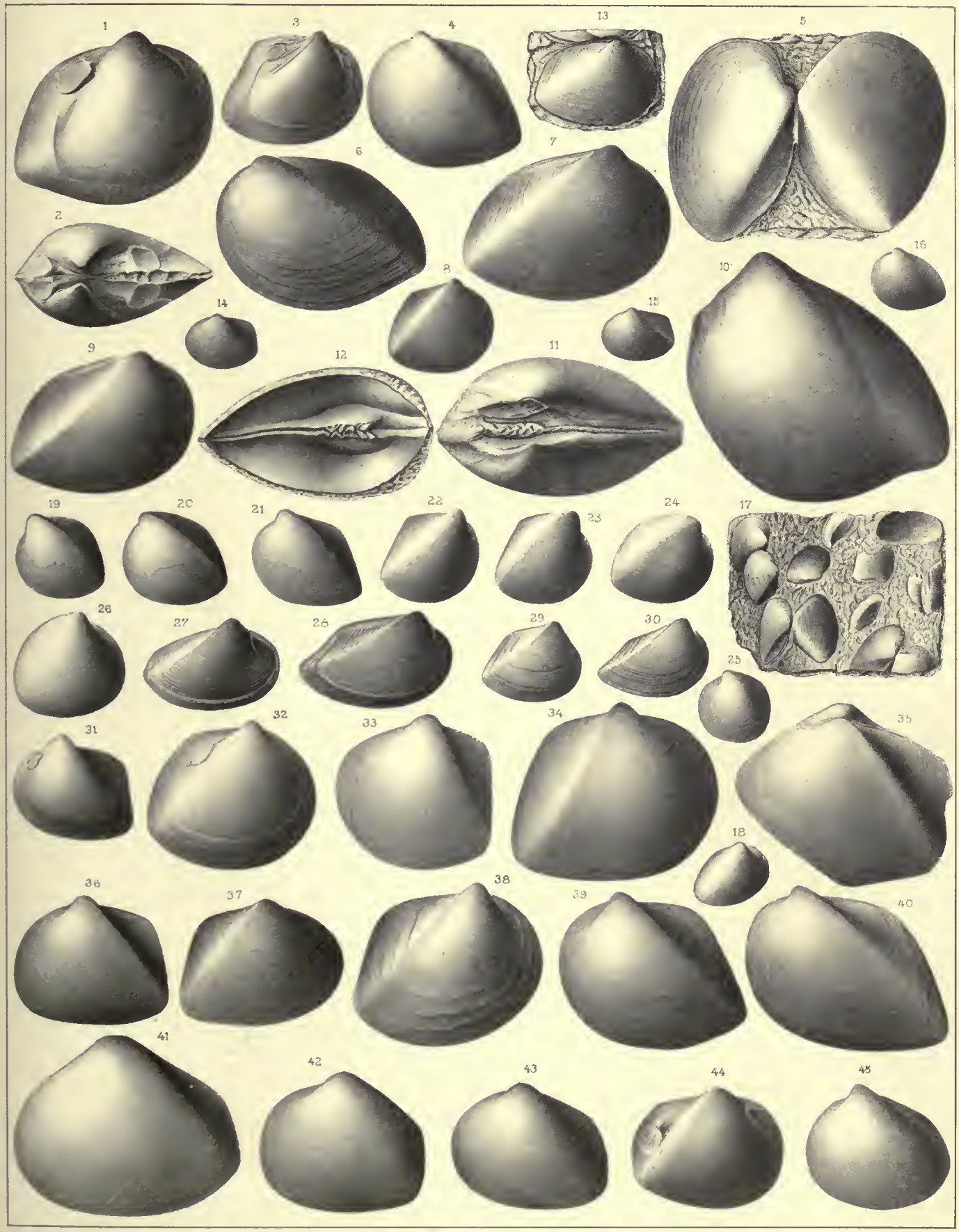
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PLATE LXXVI.

PROTHYRIS PLANULATA.

Page 460.

See Plate 94.

Fig. 1. The left side of a specimen enlarged to two diameters.
Hamilton group. *Outlet of Crooked lake, N. Y.*

PROTHYRIS LANCEOLATA.

Page 460.

Figs. 2–8. A series of specimens showing the prevailing forms in this species. Fig. 8 is enlarged to two diameters.
Hamilton group. *Eastern and central New York.*

MODIELLA PYGMÆA.

Page 514.

Figs. 9–20. A series of valves illustrating the principal varieties of form and surface characters of this species. Figures enlarged to two diameters.
Hamilton group. *Central New York.*

TELLINOPSIS SUBEMARGINATA.

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Figs. 21–31. A series of valves showing variations in size and form.
Hamilton group. *Eastern and central New York.*

HAMILTON GROUP.

(FAMILIES UNDET)

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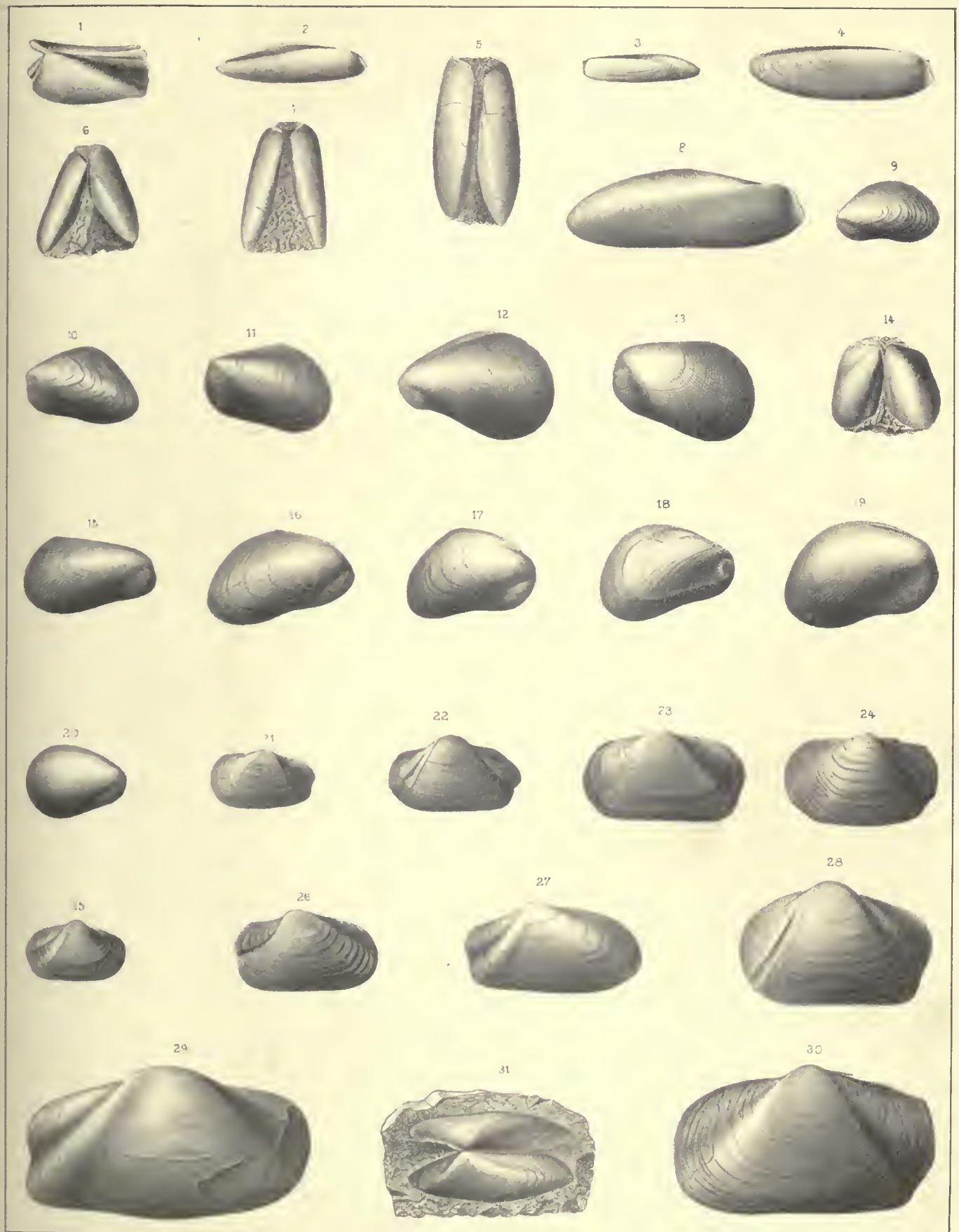
Plate LXXVI.



Riemann lith.

PLATE LXXVII.

CIMITARIA CORRUGATA.

Page 465.

Fig. 1. The right side of an imperfect specimen showing plications on the post-cardinal slope.
Hamilton group. *Monteith's point, Canandaigua lake, N. Y.*

Fig. 2. The right side of a large individual.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 3. A small left valve.
Hamilton group. *Sherburne creek, N. Y.*

Fig. 4. The right valve of a young individual, showing strong folds on the post-cardinal slope limiting the umbonal angle.

CIMITARIA ELONGATA.

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Figs. 5, 6. Two left valves showing the prevailing form of this species.
Hamilton group. *Schoharie and Onondaga Co's, N. Y.*

Fig. 7. A large right valve.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 8. A cardinal view of a specimen retaining both valves.

CIMITARIA RECURVA.

Page 467.

Fig. 9. The right valve of a small individual.
Hamilton group. *Delphi, N. Y.*

Fig. 10. The right valve of a large individual.
Hamilton group. *Madison Co., N. Y.*

Fig. 11. The cardinal view of a compressed specimen retaining both valves.

Fig. 12. The right side of the preceding.

Fig. 13. The right side of a specimen preserving the surface ornamentation.

Fig. 14. A left valve of falcate form.
Hamilton group. *Madison Co., N. Y.*

Fig. 16. An enlargement of the surface from specimen fig. 13.

CIMITARIA ANGULATA.

Page 468.

Fig. 15. A left valve of a specimen which is somewhat compressed vertically and folded along the umbonal angle. Chemung group. *Between Elmira and Waverly, Tioga Co., N. Y.*

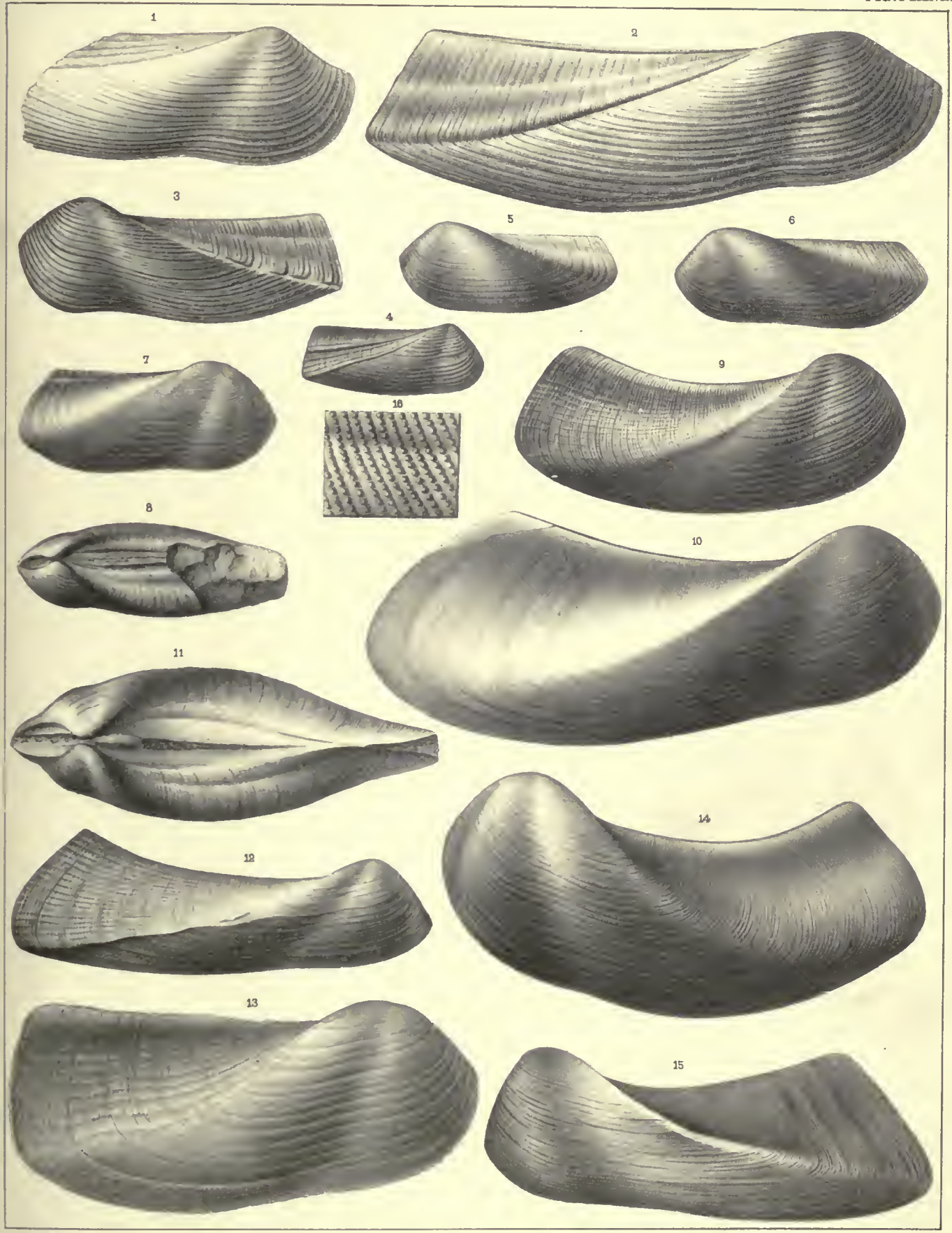
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PLATE LXXVIII.

PHTHONIA CYLINDRICA.

Page 473.

Figs. 1, 2. Two right valves showing the ordinary form of this species.
Hamilton group. *Pompey Hill and shore of Cayuga lake, Onondaga Co., N. Y.*
Figs. 3, 4. Two left valves of somewhat different proportions from the preceding specimens.
Hamilton group. *Onondaga Co., N. Y.*

PHTHONIA NODICOSTATA.

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Fig. 5. A small right valve.
Hamilton group. *Shore of Canandaigua lake, N. Y.*
Fig. 6. A larger right valve.
Hamilton group. *Near Oneonta, N. Y.*
Figs. 7, 8. Two left valves showing the surface ornamentation characteristic of this species.
Hamilton group. *Shores of Canandaigua and Cayuga lakes, N. Y.*
Fig. 9. An enlargement of a portion of the surface from the specimen fig. 7, showing the nodose character of the radii.

PHTHONIA SECTIFRONS.

Page 475.

Fig. 10. A small left valve.
Fig. 11. A large left valve narrowed by compression.
Fig. 12. A large right valve showing the form and surface characters.
Hamilton group. *Cazenovia, N. Y.*
Fig. 13. A specimen retaining both valves in conjunction.

PHTHONIA LIRATA.

Page 476.

Fig. 14. The right valve of the specimen described, as obtained from a gutta-percha impression, enlarged to three diameters.
Hamilton group. *Shore of Cayuga lake, N. Y.*

PHOLADELLA RADIATA.

Page 469.

See Plate 96.

Figs. 15–18. Two right and two left valves showing the prevailing forms of this species.
Fig. 19. Cardinal view of a compressed specimen retaining both valves.
Hamilton group. *Cazenovia, N. Y.*
Fig. 20. A right valve of unusually large size.
Hamilton group. *Fabius, N. Y.*
Fig. 21. An elongate right valve.
Lower Chemung group. *Ithaca, N. Y.*

PHOLADELLA PARALLELA.

Page 470.

Figs. 22, 23. Right and left valves.
Hamilton group. *Shore of Skaneateles lake, N. Y.*
Fig. 24. A portion of a block preserving the remains of numerous individuals of this species.
Hamilton group. *Near Fabius, N. Y.*

PLATE LXXVIII—Continued.

Pholadella Newberryi.

Page 471.

Fig. 25. A left valve showing the form and surface markings. The posterior extremity is restored in the figure. Waverly group. *Licking Co., Ohio.*

Grammysia constricta.

Page 377.

See Plate 59.

Figs. 26, 27. Two right valves enlarged to two diameters showing the form and surface characters. Fig. 26, Hamilton group. *Otsego Co., N. Y.*

Promacrus cuneatus.

Page 510.

Fig. 28. The anterior portion of an imperfect right valve.
Burlington sandstone. *Burlington, Iowa.*

Orthonota ? parvula.

Page 482.

See Plate 65.

Figs. 29–32. Four specimens retaining both valves in conjunction, showing some variation in size and proportion. Figs. 29, 30 and 31, enlarged to two diameters.
Hamilton group. *N. Y.*

Solen (Palæosolen) siliquoidea.

Page 483.

Fig. 33. The right valve described.
Hamilton group. *Schoharie Co., N. Y.*

Orthonota carinata.

Page 479.

Fig. 34. A specimen retaining both valves conjoined along the hinge, enlarged to two diameters.
Hamilton group. *Shore of Cayuga lake, N. Y.*

Fig. 35. A right valve, natural size. The posterior extremity is incorrectly restored in outline.

Orthonota ensiformis.

Page 480.

Fig. 36. A view of the right valve described as obtained from a gutta-percha impression of the natural mould. Hamilton group. *Schoharie Co., N. Y.*

Orthonota undulata.

Page 478.

Fig. 37. A young individual retaining both valves.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 38. A specimen of medium size preserving both valves, conjoined at the hinge-line.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Figs. 39, 40. Left and right valves showing the form and surface characters.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 41. The right side of a large specimen.
Hamilton group. *Bear's gulf, Schoharie Co., N. Y.*

Fig. 42. The right side of a somewhat smaller individual.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

HAMILTON & WAVERLY GROUPS.

(PHOLADELLIDÆ.)
(ORTHONOTIDÆ *etc.*)

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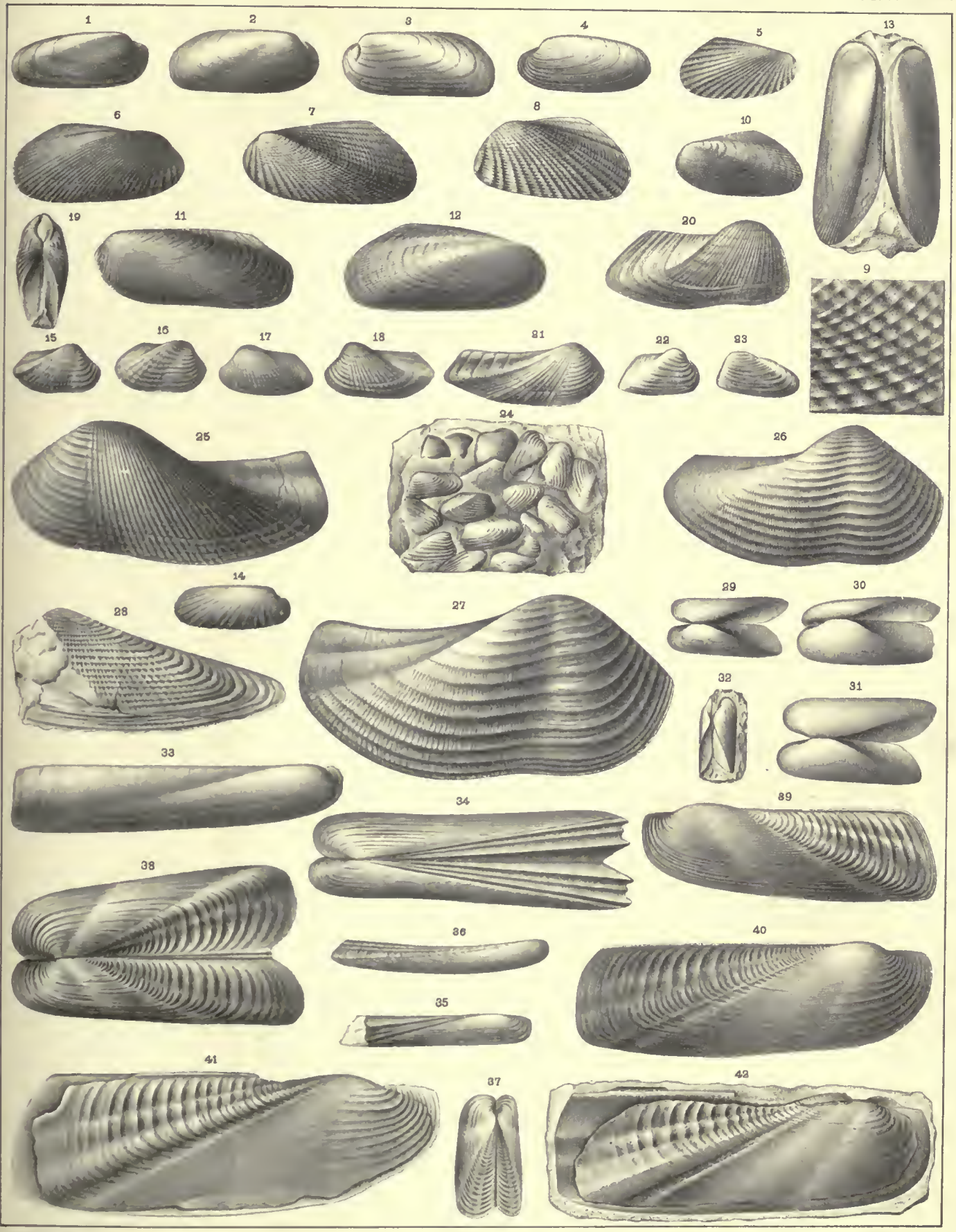
Plate. LXXVIII.



J.H. Emerton del.

Phil. Ast. lith.

PLATE LXXIX.

CYPRICARDINIA PLANULATA.

Page 484.

Figs. 1, 2. A right and a left valve of this species.
Schoharie grit. *Schoharie, N. Y.*

Fig. 3. A cast of a right valve showing muscular scars and pallial line.
Schoharie grit. *Schoharie, N. Y.*

Figs. 4, 5. Cardinal view and left side of a specimen showing the inequality of the valves and muscular scars.
Schoharie grit. *Schoharie, N. Y.*

CYPRICARDINIA INDENTA.

Page 485.

See Plate 96.

Figs. 6–8. Right and left valves showing the usual form of the species, enlarged to two diameters.
Corniferous limestone. *Babcock's hill, Oneida Co., N. Y.*

Fig. 9. An elongate right valve, enlarged to two diameters.

Fig. 10. A right valve, enlarged to three diameters.

Fig. 11. A left valve.

Fig. 12. A right valve, natural size.

Fig. 13. A small left valve, enlarged to three diameters.

Fig. 14. A right valve, enlarged to three diameters, showing the surface markings.
Hamilton group. *Ontario Co., N. Y.*

Fig. 15. An elongate left valve, enlarged to two diameters.
Hamilton group. *Shore of Canandaigua lake, N. Y.*

Fig. 16. A left valve, similar to the preceding, natural size.
Hamilton group. *Shore of Owasco lake, N. Y.*

Fig. 23. A right valve preserving the test and surface markings.
Hamilton group. *Moscow, N. Y.*

CYPRICARDINIA ARCUATA.

Page 486.

Fig. 17. A left valve of this species, enlarged to two diameters.
Chemung group. *Near Elmira, N. Y.*

CYPRICARDINIA CONSIMILIS.

Page 486.

See Plate 96.

Fig. 18. A right valve preserving a portion of the test with the surface markings and showing the posterior muscular scar, enlarged to two diameters. Referred to this species with doubt.
Waverly group. *Richfield, Summit Co., Ohio.*

Figs. 19–21. Left, right and cardinal views of a cast of the interior.
Waverly group. *Licking Co., Ohio.*

CYPRICARDINIA SULCIFERUS.

Page 487.

Fig. 22. A partial cast of the interior of a right valve, enlarged to three diameters.
Yellow sandstone. *Burlington, Iowa.*

CYPRICARDINIA ? CYLINDRICA.

Page 486.

Figs. 24, 25. Left side and cardinal views of the original specimen.
Hamilton group. *Near Louisville, Ky.*

PALÆANATINA TYPA.

Page 488.

Figs. 26, 27. Two left valves of the ordinary form.
Chemung group. *Portville, N. Y.*

Figs. 28, 35. Two right valves, showing their depressed form.
Chemung group. *Portville, N. Y.*

Figs. 36, 37. Two left valves with the cincture less developed than in figs. 26 and 27.
Chemung group. *Portville, N. Y.*

PALÆANATINA ANGUSTA.

Page 490.

Figs. 29, 30. Two right valves.
Chemung group. *Near Portville, N. Y.*

Figs. 31–34. Four left valves showing some variations in form and proportions.
Chemung group. *Near Portville, N. Y.*

PALÆANATINA SOLENOIDES.

Page 489.

Figs. 38, 39. Left and right side of a specimen retaining both valves, showing the form and surface characters.
Chemung group. *Near Portville, N. Y.*

PRORHYNCHUS QUADRATUM.

Page 492.

See Plate 96.

Figs. 40–49. A series of valves showing considerable variation in size and form.
Chemung group. *Near Smethport, Pa.*

(FAMILY ? & PALANATINIDÆ.)

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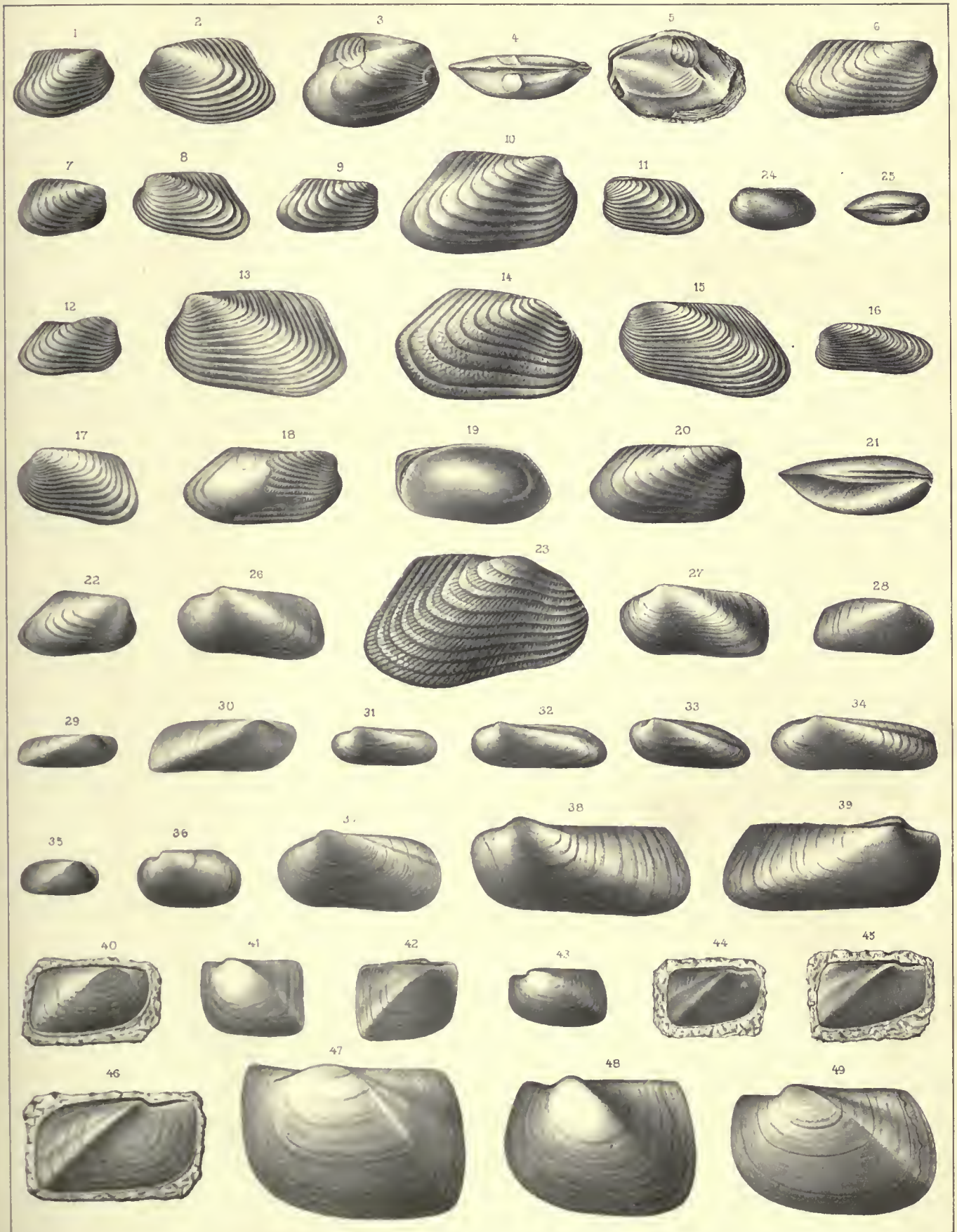
Plate LXXIX.



Phil.Ast.lith.

PLATE LXXX.

Mytilarca pyramidata.

Page 256.

Figs. 1, 2. Left side and anterior view of a cast of the interior.
Schoharie grit. *Schoharie, N. Y.*

Fig. 3. The right side of a specimen, somewhat smaller than the preceding.
Schoharie grit. *Schoharie, N. Y.*

Leptodesma ?

Fig. 4. An obscure right valve of undetermined relations.
Chemung group. *Salamanca, N. Y.*

Sphenotus (?) undatus.

Page 506.

Fig. 5. View of a left valve as obtained from a gutta-percha impression in a natural mould.
Chemung group. *Mansfield, Pa.*

Orthonota rigida.

Page 481.

Fig. 6. A right valve showing the form and surface markings.
Chemung group. *Near Elmira, N. Y.*

Modiomorpha alta.

Page 278.

See Plate 37.

Fig. 7. The right side of a distorted specimen.
Hamilton group. *Pratt's falls, N. Y.*

Panenka mollis.

Page 420.

Fig. 8. A specimen preserving both valves in conjunction, showing the form and surface characters.
Marcellus shale.

Fig. 9. Cardinal view of a small specimen retaining both valves in conjunction. Doubtfully referred to this species.

Glyptocardia speciosa.

Page 426.

See Plate 70.

Fig. 10. View of a specimen retaining both valves, showing strongly developed surface ornaments, enlarged to four diameters.

Byssopteria radiata.

Page 252.

See Plate 32.

Fig. 11. A large right valve.
Chemung group. *Mansfield, Pa.*

Amnigenia Catskillensis.

Page 516.

See Plate 40.

Fig. 12. The right valve of a very large individual.
Oneonta sandstone. *Pennsylvania.*

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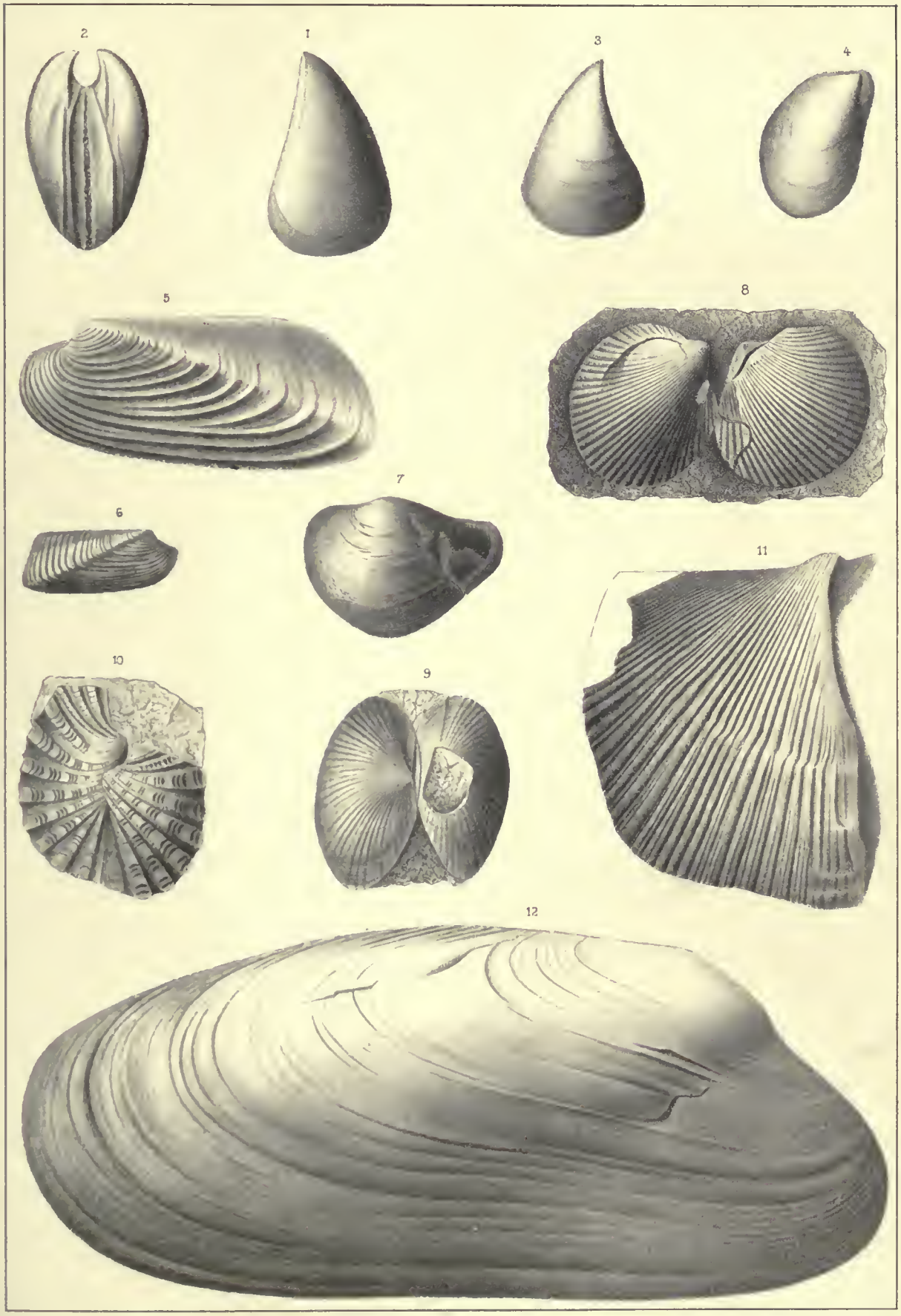
Plate. LXXX.



Riemann lith

GRAMMYSIA UNDATA.

Page 379.

See Plates 61, 64.

Fig. 21. A left valve.
Chemung group. *Near Olean, N. Y.*

GRAMMYSIA OVATA.

Page 358.

Fig. 22. A specimen retaining both valves in conjunction.
Corniferous limestone. *Delaware, Ohio.*

GRAMMYSIA DUPLICATA.

Page 380.

Fig. 23. A right valve showing surface ornamentations.
Chemung group. *Warren, Pa.*

Fig. 23*a*. A profile of the preceding.

GRAMMYSIA GLABRA.

Page 369.

Fig. 24. A partial cast of a left valve showing the muscular scars and lines of growth.
Chemung group. *Warren, Pa.*

GRAMMYSIA BISULCATA.

Page 359.

See Plates 54, 56.

Fig. 25. A right valve showing strong concentric undulations of the surface and fine radiating striæ.
Hamilton group. *Albany Co., N. Y.*

GRAMMYSIA SUBARCUATA.

Page 375.

See Plate 61.

Fig. 26. Anterior view of a specimen showing a very strongly developed lunule.
Chemung group.

GRAMMYSIA ARCUATA.

Page 373.

See Plates 61, 63.

Fig. 27. The left side of a specimen showing concentric undulations.
Hamilton group. *Pratt's falls, N. Y.*

EUTHYDESMA SUBTEXTILE.

Page 385.

See Plate 63.

Fig. 28. The hinge of a left valve showing the straight ligamental area.

Fig. 29. An enlargement of the surface from another specimen.
Portage group. *Near Portland Harbor, Chautauqua Co., N. Y.*

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PLATE XCIV—Continued.

PANENKA ABRUPTA.

Page 423.

See Plate 69.

Fig. 16. The left side of a specimen with the valves slightly displaced.
Hamilton group. *Near Cumberland, Md.*

PANENKA EQUILATERA.

Page 419.

See Plate 69.

Fig. 17. The left side of a specimen showing the form and surface markings.
Hamilton group. *Delphi, N. Y.*

PANENKA MULTIRADIATA.

Page 417.

See Plate 69.

Fig. 18. The right side of the specimen described.
Corniferous limestone. *Clarence Hollow, Erie Co., N. Y.*

PARARCA PRÆCEDENS.

Page 429.

Fig. 19. An imperfect left valve as obtained from a gutta-percha impression of a natural mould.
Corniferous limestone. *Cayuga, Canada West.*

PARARCA ERECTA.

Page 432.

See Plate 70.

Fig. 20. A left valve showing the form and surface markings. A profile of this valve is represented at the right of the figure.
Waverly group. *Warren, Pa.*

Fig. 21. The hinge of a right valve showing the minute crenulations.
Waverly group. *Warren, Pa.*

PARARCA VENUSTA.

Page 431.

Fig. 22. A right valve.
Chemung group. *Warren, Pa.*

CARDIOLA FLUCTUANS, Barrande.

See Plate 70.

Fig. 23. A right valve showing the form and surface ornamentations. Introduced for comparison with the species of PANENKA, PARARCA and allied forms.
Silurian. *Bohemia.*

LUNULICARDIUM TRANSVERSUM.

Page 439.

Fig. 24. Cardinal view of the specimen described, showing the hiatus along the cardinal line.
Chemung group. *Elmira, N. Y.*

Fig. 25. The left side of the preceding.

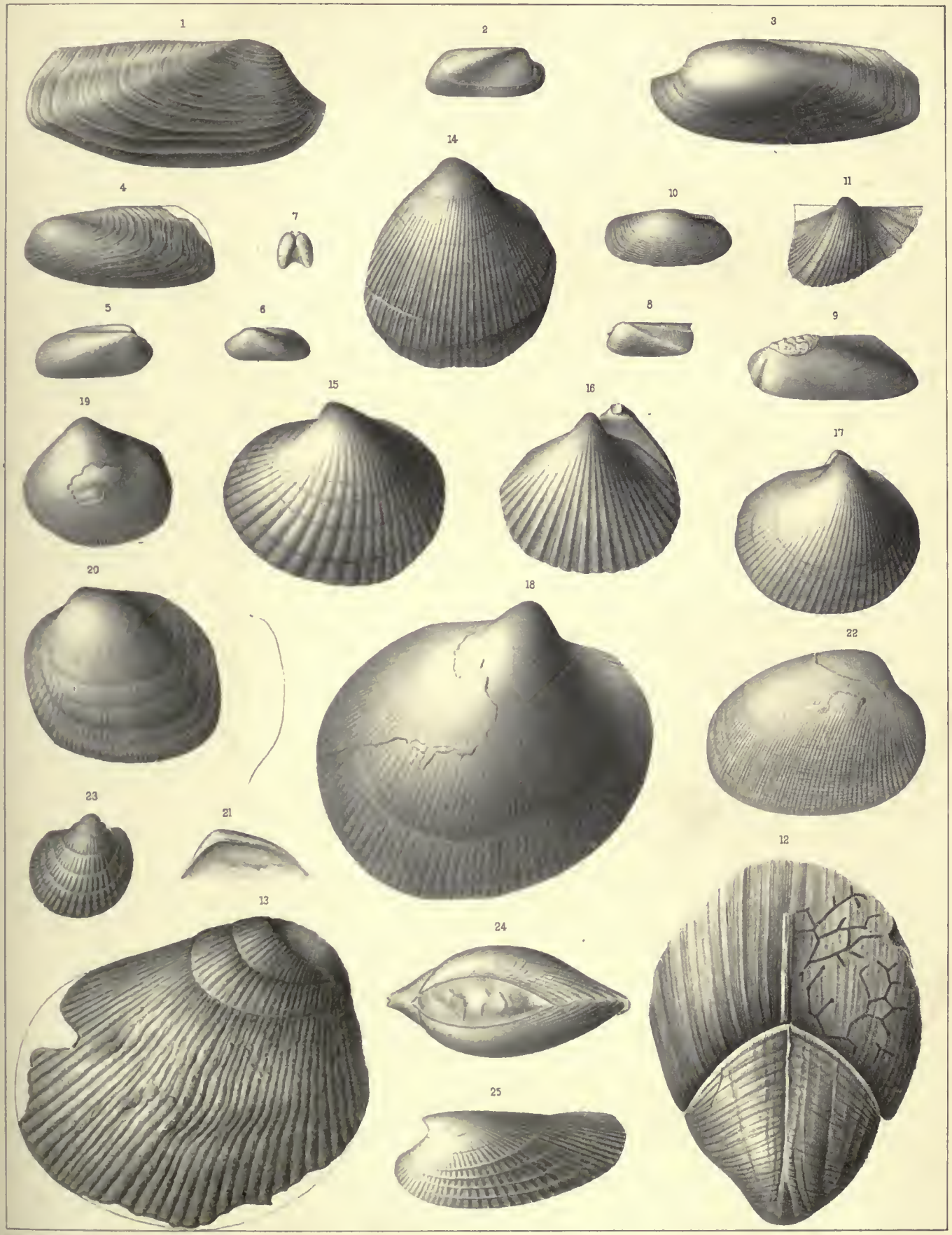
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PLATE XCV.

Edmondia Philipi.

Page 387.

See Plate 64.

Figs. 1–4. A series of valves showing the prevailing characters of this species.
Chemung group. *Alleghany Co., N. Y.*

Edmondia obliqua.

Page 388.

See Plate 64.

Fig. 5. A left valve.
Chemung group. *Mansfield, Pa.*

Fig. 6. A larger left valve showing obscure radiating lines.
Chemung group. *Hobbieville, N. Y.*

Fig. 7. A right valve of this species.
Chemung group. *Rockville, N. Y.*

Fig. 8. A specimen preserving both valves in conjunction.
Chemung group. *Mansfield, Pa.*

Edmondia subovata.

Page 389.

See Plate 64.

Fig. 9. A well-preserved specimen showing both valves in conjunction.
Chemung group. *Mansfield, Pa.*

Fig. 10. A small right valve.
Chemung group. *Philipsburgh, Alleghany Co., N. Y.*

Fig. 11. A left valve.
Chemung group. *Hobbieville, Alleghany Co., N. Y.*

Fig. 12. A large right valve.
Chemung group. *Mansfield, Pa.*

Edmondia Burlingtonensis.

Page 390.

See Plate 64.

Figs. 13, 14. Two valves showing the usual characters of this species.
Yellow sandstone. *Burlington, Iowa.*

PLATE XCV—Continued.

EDMONDIA RHOMBOIDEA.

Page 386.

See Plates 64, 75.

Fig. 15. A left valve showing the anterior muscular scar.
Fig. 16. A smaller and more convex right valve.
Chemung group. *Near Panama, N. Y.*

EDMONDIA ? TENUISTRIATA.

Page 393.

See Plate 63.

Fig. 17. A left valve showing the form and surface characters.
Chemung group. *Elmira, N. Y.*

PARACYCLAS ELLIPTICA

Page 440.

See Plate 72.

Fig. 18. Cardinal view of a partial cast of the interior, showing the posterior diverging furrows.
Hamilton group. *Falls of the Ohio river.*

PARACYCLAS LIRATA.

Page 441.

See Plate 72.

Fig. 19. Cardinal view of a specimen showing the small diverging ligamental grooves.
Hamilton group. *Charlestown, Indiana.*

PARACYCLAS ? PAUPER.

Page 446.

See Plate 75.

Fig. 20. The left side of a specimen retaining both valves.
Chemung group. *Portville, N. Y.*

PARACYCLAS ROTUNDA.

Page 444.

See Plate 63.

Fig. 21. A large right valve.
Chemung group. *Broome Co., N. Y.*

PARACYCLAS ERECTA.

Page 445.

Fig. 22. The right side of a specimen showing the form of the shell.
Chemung group. *Warren, Pa.*

PARACYCLAS OHIOENSIS.

Page 442.

See Plate 72.

Fig. 24. The left side of a specimen showing the form and surface characters.
Hamilton group. *Falls of the Ohio river.*

PARACYCLAS TENUIS.

Page 443.

See Plate 72.

Fig. 25. The right valve, natural size, showing the form and surface markings.
Hamilton group. *Shore of Skaneateles lake, N. Y.*

SCHIZODUS, sp. undetermined.

Fig. 26. The interior of a left valve as obtained from a gutta-percha impression showing the cardinal teeth, muscular scars and pallial line.
Hamilton group. *Pa.*

SCHIZODUS GREGARIUS.

Page 452.

See Plate 75.

Fig. 27. A left valve, natural size.
Chemung group. *Near Tioga, Pa.*

SCHIZODUS EMINENS.

Page 457.

Fig. 28. A large right valve.
Chemung group. *Near Guilford, Chenango Co., N. Y.*

SCHIZODUS ÆQUALIS.

Page 459.

See Plate 75.

Fig. 29. The left side of a specimen.
Waverly group. *Licking Co., Ohio.*

CYTHERODON NASUTUS.

Page 511.

See Plate 75.

Fig. 30. The left side of the typical specimen, which is a cast of the interior, showing muscular scars.
Hamilton group. *Hardy Co., Va.*

DYSTACTELLA SUBNASUTA.

Page 512.

See Plate 51.

Fig. 31. Cardinal view of a specimen retaining the test, showing the fold or callosity in front of the beaks.
Hamilton group. *Near Louisville, Ky.*

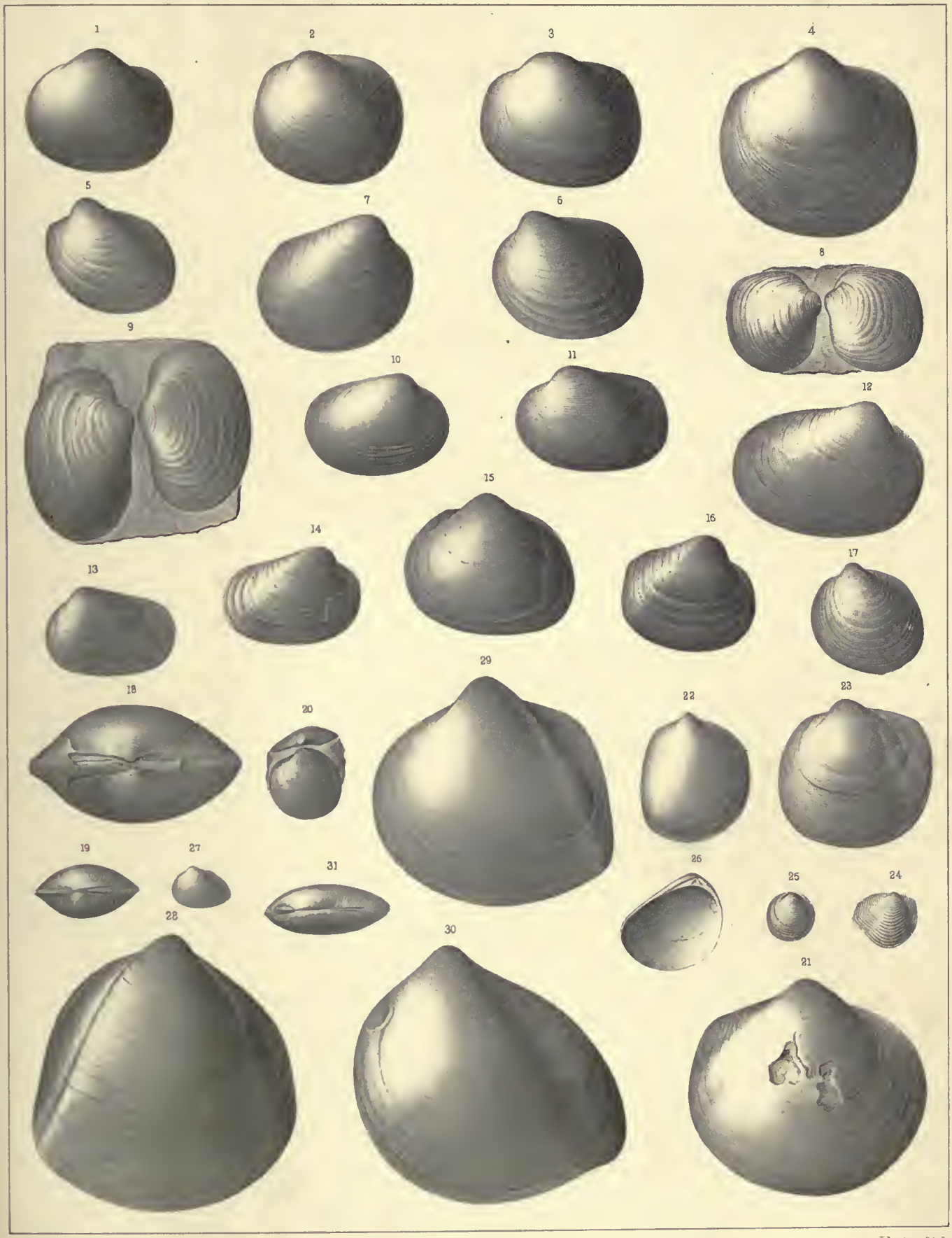
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PLATE XCVI.

PHOLADELLA RADIATA.

Page 469.

See Plate 78.

Fig. 1. A cardinal view of a specimen showing the convexity of the valves.
Hamilton group. *Near Cumberland, Md.*, $\frac{1}{1}$,

CYPRICARDINIA INDENTA.

Page 485.

See Plate 79.

Fig. 2. A right valve redrawn from the specimen fig. 7, plate 79.
Upper Helderberg group. *Babcock's hill, N. Y.*

CYPRICARDINIA CONSIMILIS.

Page 486.

See Plate 79.

Fig. 3. A right valve with the beak broken away.
Waverly group. *Warren, Pa.*

PALÆANATINA SINUATA.

Page 491.

Fig. 4. A left valve showing the form and proportions.
Chemung group. *Warren, Pa.*

PRORHYNCHUS QUADRATUM.

Page 492.

See Plate 79.

Fig. 5. A large left valve.
Chemung group. *Near Smethport, Pa.*

PRORHYNCHUS NASUTUM.

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Fig. 6. A specimen retaining both valves in conjunction. The anterior nasute extension of the left valve has been broken away.
Chemung group. *Warren, Pa.*

PRORHYNCHUS ANGULATUM.

Page 493.

Fig. 7. A large right valve.
Chemung group. *Warren, Pa.*

GLOSSITES ELLIPTICUS.

Page 498.

Fig. 8. The right side of a specimen with the valves partially open and attached by the ligament.
Chemung group. *Mansfield, Pa.*

GLOSSITES LINGUALIS.

Page 497.

Fig. 9. A left valve of medium size.
Chemung group. *Mansfield, Pa.*

Fig. 10. A large left valve.
Chemung group. *Mansfield, Pa.*

Fig. 11. A small right valve somewhat constricted at the anterior end.
Chemung group. *Mansfield, Pa.*

GLOSSITES DEPRESSUS.

Page 496.

See Plate 40.

Fig. 12. A left valve redrawn from the specimen fig. 17, plate 40.
Chemung group. *Near Elmira, N. Y.*

GLOSSITES PROCERUS.

Page 499.

Fig. 13. A left valve showing the elongate form of this species.
Chemung group. *Mansfield, Pa.*

GLOSSITES SUBNASUTUS.

Page 500.

Fig. 14. A left valve of this species.
Chemung group. *Mansfield, Pa.*

GLOSSITES PATULUS.

Page 501.

Fig. 15. A left valve.
Chemung group. *Mansfield, Pa.*

Fig. 16. A smaller right valve.
Chemung group. *Mansfield, Pa.*

GLOSSITES RUDICULA.

Page 498.

Fig. 17. A left valve of the ordinary form.
Chemung group. *Nelson, Tioga Co., Pa.*

GLOSSITES TERETIS.

Page 494.

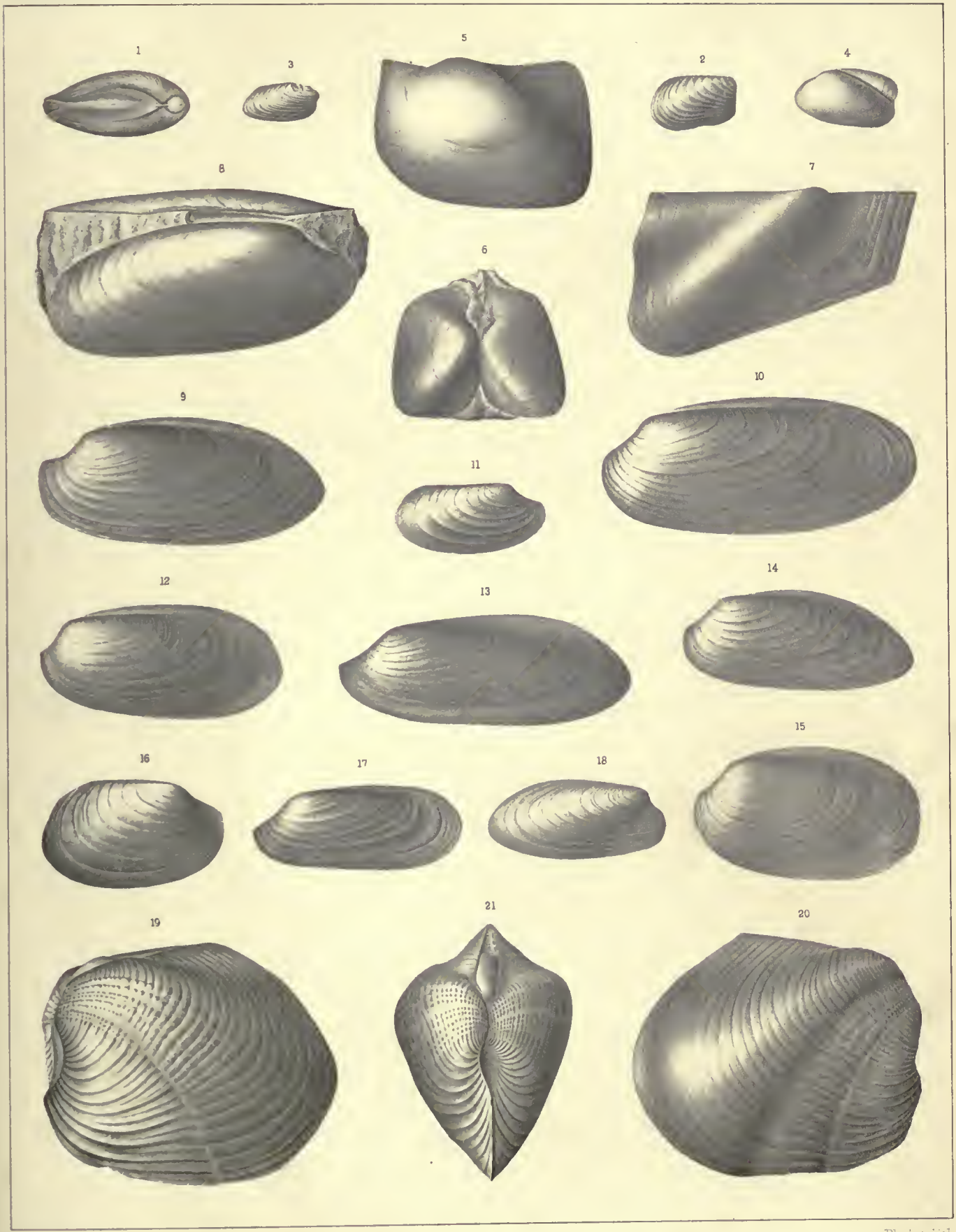
Fig. 18. The right side of a specimen showing the form and surface markings.
Corniferous limestone. *Littleville, N. Y.*

GRAMMYSIA NODOCOSTATA.

Page 360.

See Plates 55, 56, 57.

Figs. 19–21. Left, right and anterior views of a specimen preserving nearly its normal form.
Hamilton group. *Schoharie Co., N. Y.*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Natural history of New York

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